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The nature of the relationship between multiple control beliefs and exercise behavior: Considering the role of socioeconomic status.

by

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ABSTRACT

Two studies served as the basis of this dissertation project which examined the role of socioeconomic status (SES) and multiple kinds of control on exercise in two samples: a community sample (Study 1) and a sample of patients attending cardiac rehabilitation (Study 2). Study 1 examined whether three different types of control, namely perceived mastery, self-efficacy (SE) and perceived behavioral control (PBC), were distinct from each other. Study 1 also examined whether any of the control beliefs served as a mediator between SES and exercise intentions, and SES and moderate effort exercise. Results of an exploratory factor analysis showed that mastery, SE and PBC all formed separate latent construct, suggesting that the beliefs could be distinguished. Results of meditation analyses demonstrated that mastery beliefs and SE appeared to mediate the relationship between SES (income, education, social status, and occupation) and exercise. For exercise intentions, SE and PBC appeared to act as partial mediators. These results suggest that for moderate effort exercise, generalized control beliefs, particularly beliefs surrounding personal constraints in one's life, appear to play role. However, for intentions, behavioral specific control beliefs seem to be particularly important.

Study 2 examined the role of SES and control beliefs on frequency of moderate effort exercise during and one month after cardiac rehabilitation (CR). For this study control beliefs reflected perceptions of control surrounding patient's heart problem, SE for exercise and PBC. Results showed positive associations among the control beliefs, intentions and behavior. SES was not related to exercise during CR, but income and social status were related to exercise after CR. Exercise frequency during CR was most

strongly associated with SE, although only perceived control over the heart problem emerged as significant in the regression analyses. For exercise frequency after CR scheduling SE emerging as the key correlate from the regression analyses. The findings from this study highlights the potential importance of assessing multiple types of exercise SE in CR patients, and suggest an important avenue for future research may be to work with scheduling SE in CR patients.

Table of Contents

Section		Page
1. Introduction	Introduction	1
	Types of control	6
	Control beliefs and health	10
	Control beliefs and health behaviors	12
	Socioeconomic status	19
	Socioeconomic status and health	30
	Socioeconomic status and health behaviors	33
	Control beliefs and socioeconomic status	37
	Control beliefs, socioeconomic status and health	38
	Control beliefs, socioeconomic status and health behaviors	40
	Summary	41
	References	44
2. Study 1	The influence of control beliefs on exercise intentions and behavior: considering the role of socioeconomic status.	66
	Method	75
	Participants	75
	Measures	75
	Procedure	80
	Analyses	82
	Results	84
	Data screening	84
	Descriptive statistics	86
	Exploratory factor analyses	88
	Regression analyses among control beliefs	90
	Associations among control beliefs, SES and exercise	94
	Multiple mediator analyses predicting behavior	96
	Multiple mediator analyses predicting intentions	98
	Discussion	100
	References	116
3. Study 2	The role of socioeconomic status and control beliefs on frequency of exercise during and after cardiac rehabilitation.	164
	Method	172
	Participants	172

	Procedures	173
	Measures	174
	Analyses	178
	Results	179
	Data screening	179
	Descriptive Statistics	181
	Regression analyses predicting exercise during rehabilitation	183
	Regression analyses predicting exercise after rehabilitation	185
	Discussion	186
	Endnotes	202
	References	204
4. Discussion		246

Appendices

2-A	Study 1 Information letter	156
2-B	Study 1 Survey	158
2-C	Study 1 Reminder card	163
3-A	Study 2 Information Letter	226
3-B	Study 2 Survey 1	228
3-C	Study 2 Survey 2	232
3-D	Study 2 Survey 3	235
3-E	All possible combination regression predicting Time 2 behavior	236
3-F	All possible combination regression predicting Time 3 behavior	241

List of Tables

Table		Page
2-1	Demographic Profile of Respondents	133
2-2	Descriptive statistics of study variables.	135
2-3	Pattern coefficients, internal consistencies and communality estimates from principal axes analysis of control items	136
2-4	Correlations among study variables	137
2-5	Prediction of Intentions from Control Variables	138
2-6	Prediction of Exercise from Control Variables	140
2-7	Prediction of Exercise from SES and Control Beliefs	141
2-8	Prediction of Exercise Intentions from SES and Control Beliefs	142
2-9	Indirect Effects of SES on Exercise Through Control Beliefs.	143
2-10	Indirect Effects of SES on Exercise Intentions Through Control Beliefs.	144
3-1	Demographic and medical profile of participants	217
3-2	Descriptive statistics for study variables.	219
3-3	Correlations between SES, control beliefs, exercise intentions and behavior.	220
3-4	Correlations between control beliefs, intentions and behavior	221
3-5	Summary of Hierarchical Regression Analyses for SES and Time 1 Variables Predicting Time 2 Exercise Behavior	222
3-6	Summary of Hierarchical Regression Analyses for SES and Time 2 Variables Predicting Time 3 Exercise Behavior	223

List of Figures

Figure		Page
1-1	Continuum of control beliefs by specificity	65
2-1	Flow of participants through the study	145
2-2	Illustration of Simple Mediation Model	146
2-3	Illustration of Multiple Mediator Model	147
2-4	Direct effects model of income on exercise through control beliefs.	148
2-5	Direct effects model of education on exercise through control beliefs.	149
2-6	Direct effects model of occupation on exercise through control beliefs.	150
2-7	Direct effects model of social status on exercise through control beliefs.	151
2-8	Direct effects model of income on exercise intentions through control beliefs.	152
2-9	Direct effects model of education on exercise intentions through control beliefs	153
2-10	Direct effects model of occupation on exercise intentions through control beliefs	154
2-11	Direct effects model of social status on exercise intentions through control beliefs	155
3-1	Flow of participants through the study	224
3-2	Study timeline and assessments	225

I. INTRODUCTION

According to Health Canada (1999), inactivity is a significant threat to the health and well-being of Canadians. Inactivity is associated with an increased risk of cardiovascular disease, osteoporosis, Type II diabetes and certain cancers (Katzymaryk, Gledhill, & Shephard, 2000). While the health benefits associated with regular physical activity are well known and documented (Health Canada; Blair & Morrow, 1998), in Canada estimates suggest that over one half of the adult population is not active enough to achieve health benefits (Canadian Fitness & Lifestyle Research Institute, 2002). Physical inactivity is considered a modifiable risk factor for disease, and significant health benefits could be obtained if activity rates were increased (US Department of Health and Human Services, 1996). Thus, studying factors that influence physical activity behavior should be an important goal of health research.

Physical activity is a complex behavior, and there are many ways in which it can be categorized. Physical activity can be defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" (Casperson, Powell & Christenson, 1985, p.126). Physical activity can vary in terms of intensity, duration and frequency of performance, and can be further categorized by activity performed at home, work and at leisure. Leisure time activity can further be divided into categories such as sports, physical conditioning, household tasks and other related activities (Casperson et al.). The term "physical activity" is often used interchangeably with the term "exercise", and while both are related and may share common elements, exercise is generally considered a subcomponent of physical activity. Exercise can be defined physical activity that is planned, structured, repetitive and performed with the objective of maintaining or

improving physical fitness (Casperon et al.). Most conditioning and sports activities are planned, structured and repetitive, and are generally performed to improve or maintain fitness (Casperson et al). Most household or occupational activities (or other daily physical tasks) are not explicitly planned or structured, and are not performed with physical fitness as a goal. If such activities are performed in such a manner to improve fitness, Casperson et al. argue that they should be considered as exercise.

In the dissertation studies, the term exercise is generally used, as the interest is with activities that are planned and structured during leisure time, such as various sports, brisk walking, swimming, biking, weight training etc. These activities seem to be best categorized as exercise, as they are they planned, structured and repetitive (Casperson et al., 1985). Additionally in cardiac rehabilitation patients, physical activity is used to help improve cardiovascular health, and therefore the type of activity being performed is probably best described as 'exercise'. Therefore, the outcome of interest in the dissertation studies is exercise.

Perceived Control

A sense of personal control has been recognized as an important psychological concept in health research (Steptoe & Appels, 1989; Steptoe & Wardle, 2001). In general, personal control can be described as an individual's beliefs about the degree to which he/she is able to control, influence, or bring about certain outcomes (Peterson & Stunkard, 1989; Taylor & Seeman, 1999). Perceived control is sometimes thought of as a personality construct or individual difference variable (Skinner, 1996), but others argue that control beliefs, including perceived mastery, are a "flexible set of interrelated beliefs that are organized around interpretations of prior interactions in specific domain"

(Skinner, 1995, p.4). These belief sets are constructed by individuals and based partly on previous experiences with the social and physical environment. As such, control beliefs are also open to new experiences, and as such can be changed (Skinner, 1995).

It has been argued that research on control has been hampered by its own success. The popularity and relevance of control in many areas of psychology has resulted in dozens of control related constructs and measures (Haidt & Rodin, 1999). For example, in her review Skinner (1996) notes over 100 terms used to describe the variety of constructs related to control, such as sense of control, perceived control, cognitive control, efficacy, helplessness, autonomy, and mastery. The importance of perceived control is reflected in many modern health behavior theories (e.g., Health Belief Model, Social Cognitive Theory, Health Locus of Control, Theory of Planned Behavior) which all include some aspect of control as an influence on behavior (Conner & Norman, 1996). In part, this can add to the confusion around what perceived control is and how it should be conceptualized, as different aspects of control have been included in different theories. While control beliefs are found in many contemporary theories, perceived control is not simply an isolated construct or a single measure (Skinner, 1995). The concept of control also exists as a theory in and of itself, where control beliefs are hypothesized to positively influence a variety of outcomes (e.g., Skinner 1995). However, common among control beliefs in these theories is that beliefs and judgments about one own capabilities are important influences on behavior.

There are many ways in which control beliefs can be conceptualized and operationalized, thus organizing and distinguishing the different constructs from each other (Skinner, 1996). For example, theorists and researchers often distinguish between

objective (actual) or perceived (an individuals belief about how much control is available) control, with some arguing that perceptions of control are more important to functioning than actual control (Burger, 1989). Control beliefs can also be distinguished in terms of agents, means and ends (Skinner). Agents refer to individuals (or groups) who exert control, means refer to the path through which control is exerted and ends refer to the outcomes over which control is exerted (Skinner). For example, the connection between people and outcomes, that is, the extent to which one can control or produce desired outcomes and prevent undesired outcomes are termed agent-ends beliefs (also called 'control beliefs') under Skinner's (1995; 1996) framework. Thus, the belief that one can control their life, that they have control over aspects of their health, such as exercise, may all be considered agent–ends beliefs.

Control beliefs can also be distinguished in terms of their specificity (Skinner, 1995; 1996). Control beliefs can be arranged along a continuum (see Figure 1) from the very general or global to very situation or behavior specific, and thus can be characterized by distinctions in terms of specificity (Skinner, 1996). At one end of the continuum are distal or generalized control beliefs which span areas of life (e.g., the extent to which life chances or important life events in general are under ones personal control). At the other end of the continuum are very proximal beliefs, relevant to specific behaviors or situations (e.g., the extent to which one believes physical activity behavior to be under personal control). In between these two ends are control beliefs that focus on certain life domains such as home life, work, and health (e.g., the extent to which one believes that there are things they can do to prevent getting sick). If control beliefs exist on a continuum, as proposed by Skinner (1966), then it seems plausible that beliefs that are

closer on the continuum to the requisite behavior (i.e., beliefs most proximal to the behavior) should be more strongly related to the behavior than beliefs that are further away from the behavior of the continuum (i.e., more distal beliefs).

The use of multiple control beliefs in a single study makes it possible to "investigate the connections among beliefs," analyzing their potentially unique effects (Skinner, 1995, p. 30). Recent research has begun to explore the relationship between different aspects of control (Rodgers, Conner & Murray, in press-a; Trafimow, Sheeran, Conner & Finlay, 2002), however most of this research has been at the behavioral level of specificity, and it has not examined more generalized control beliefs (Armitage, 2003). It is possible that some beliefs are more important in predicting certain outcomes or within certain domains (e.g., among people with lower SES, among CR patients). The conceptualization of control presented in these two studies is based in part on Skinner's (1995; 1996) work, with the primary focus being on differences in terms of domain specificity.

In both health and behavioral research several different constructs of control have figured prominently, notably mastery, self-efficacy (from social cognitive theory) and perceived behavioral control (from the theory of planned behavior). Perceived mastery is thought to be a particularly powerful psychological resource, influencing health and well-being (Rodin & Salovey, 1989), and self-efficacy and PBC are part of two of the most influential social cognition models in health behavior research (Norman & Conner, 1996), therefore these constructs were examined in the current dissertation studies. The way in which these constructs differ, following Skinners framework, follows, beginning with the most distal construct of control, mastery.

Types of Control

Mastery

The construct of *mastery* originates from research in stress and coping, and refers to the extent to which people see themselves as being in control of important factors that affect their lives (Pearlin & Schooler, 1978; Pearlin, Menaghan, Lieberman & Mullan, 1981). As part of the stress process, a sense of mastery is viewed as a key psychological resource, potentially buffering the relationship between stressors and health (Pearlin et al.; Pudrovska, Schieman, Pearlin & Nguyen, 2005). Other researchers have described the importance of perceived of mastery over life events as a part of basic human motivation (Rodin, Timko & Harris, 1986). Because the construct of mastery deals with beliefs that span areas of a person's whole life, it is considered a global or generalized form of control (Schieman, 2003), with the majority of research focusing on the relationship between mastery and general health status, not specific health behaviors. Individuals who possess a high sense of mastery believe that they are able to influence the environment and bring about desired outcomes (Pudrovska et al.). In comparison, individuals who have a low sense of mastery feel less able to control circumstances and life events (Pudrovska et al.). Additionally, some researchers (Lachman & Weaver, 1998; Marmot, Fuhrer, Ettner, Marks, Bumpass & Ryff, 1998) have also distinguished between multiple components of mastery, namely *perceived mastery* (e.g., the belief that one can control important areas of their life) and *personal constraints* (e.g., the extent one believes that there are obstacles or factors beyond one's control that interfere with reaching goals).

Self-efficacy

In Social Cognitive Theory, control is conceptualized in terms of *self-efficacy* (Bandura, 1986). In general, self-efficacy refers to "people's beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives" (Bandura, 1991, p. 257). At the behavioral level, self-efficacy beliefs are concerned with "the exercise of direct control over the modifiable behavioral aspects of health" (Bandura, 1997, p. 160), and would therefore be considered a proximal (behavioral) control belief. In general, Bandura refers to self-efficacy as the perceived capability to perform a specific behavior and, according to Bandura, while people may believe that certain outcomes (e.g., better health) are achieved by performing a given behavior (e.g., exercise), they will not attempt to perform the behavior if they believe that they can not successfully execute the behavior (efficacy expectation).

Different types of self-efficacy, such as task and coping self-efficacy have also been distinguished in the literature (Maddux, 1995). Task self-efficacy refers to an individuals' confidence to perform elemental aspects of the task whereas coping self-efficacy refers to an individuals' confidence to perform the given behavior under challenging conditions. Rodgers and colleagues (Rodgers & Sullivan; 2001; Rodgers, Hall, Blanchard, McAuley & Munroe, 2002a; Rodgers, Wilson, Hall, Fraser & Murray, in press-b) have also supported the idea that there are different types of efficacy, and include scheduling self-efficacy (an individuals' confidence to organize and schedule regular exercise) as an important component of coping self-efficacy for exercise behavior (Rodgers et al., 2002a; in press-b).

Perceived Behavioral Control

In the Theory of Planned Behavior (TPB), control beliefs refer to the presence of factors that may facilitate or impair behavioral performance (thereby limiting volitional control), and are represented by the construct *perceived behavioral control (*Ajzen, 2002b). As the name implies, perceived behavioral control (PBC) is behavioral specific and considered a proximal determinant of both behavioral intention and behavior (Ajzen). In general, PBC refers to " peoples expectations regarding the degree to which they are capable of performing a given behavior, the extent to which they have the requisite resources, and believe they can overcome whatever obstacles they may encounter" (Ajzen, 2002b, p.677). Accordingly, when individuals believe that they have the resources and that there are few obstacles to behavioral performance, they should have a high degree of confidence in their ability to perform the behavior and thus demonstrate a high degree of perceived control (Ajzen). Thus, an implication is that PBC has two separable components: controllability and ease/ difficulty or self-efficacy. However, Ajzen (1991) and others has also described PBC as being analogous to self-efficacy, although Bandura (1992) has argued that self-efficacy and PBC are not entirely synonymous, creating a lack of clarity with the PBC construct (Conner & Armitage, 1998).

Summary of Control Constructs

Skinner (1996) has detailed an array of constructs that fall under the rubric of control, and provided ways in which they can be distinguished from one another. Perceptions of mastery, self-efficacy and PBC have all figured prominently in health and behavioral research and are thought to be conceptually distinct from each other. For example, mastery is thought to be a more generalized type of control, reflecting the

degree to which an individual believes that they are in control of important life events (control belief) , whereas self-efficacy refers to the degree to which people are confident that they can control aspects of a specific behavior (capacity belief). Thus, one way in which control beliefs can be distinguished is by the specificity, as previously discussed.

However, control beliefs may also be differentiated from each other in other ways. Lachman (2000) differentiates control beliefs primarily in terms of 'agency' beliefs and 'control' beliefs. Agency beliefs refer to perceived abilities of the self to perform a given action (Lachman). This would be reflected in perceived mastery beliefs (the extent to which one believes he/she can influence areas of his/her life) and self-efficacy beliefs (the extent to which one believes they can perform exercise). Control beliefs refer to an individual's belief about the responsiveness of the environment, and the extent to which one believes that there may be circumstances outside one's control that prevent them from reaching a given outcome. This would be reflected in the personal constraints construct (the extent to which people believe that there are obstacles or barriers in the life preventing them reaching life goals) and to some extent it would also be represented in the PBC construct. PBC refers to presence or absence of factors that may facilitate or impair behavioral performance, and includes people's expectations about the degree to which they can control their behavior (an agency belief according to Lachman). However, according to Ajzen (2002), PBC also refers to the extent to which one has the necessary resources and the belief that they can overcome any obstacles, which would arguably be categorized as a control belief by Lachman. Thus, using Lachman's distinction, both agency and control beliefs could be at any level of specificity (i.e., it could be over a specific behavior, over health, or over life in general).

Further, in the self-efficacy and PBC literature, some researchers have made similar arguments for the distinction between the two constructs in terms of internal and external beliefs. Efficacy based beliefs have been ladled as 'internal' beliefs and beliefs surrounding barriers whereas external constraints have been labeled as 'external' beliefs (Hagger et al., 2002; Terry & O'Leary, 1995). If one of the ways in which control beliefs can be distinguished is between agency (or internal) beliefs and control (external) beliefs, then we might expect that perceived mastery and self-efficacy efficacy beliefs would be more strongly correlated to each other (i.e., the agency beliefs) and constraints and PBC may be more strongly correlated (i.e., the control beliefs).

Despite the numerous ways in which control beliefs could be distinguished from one another, little research has examined the extent to which individuals interpret mastery, self-efficacy and PBC beliefs in a different (or similar) fashion. Therefore the extent to which the constructs are psychometrically distinct is not known.

Control Beliefs and Health

The idea that perceptions of control might be related to health is not new. Early research in this area focused on internal versus external locus of control (Rotter, 1966), and was often discussed as the sense of powerlessness. For example, in one of the earlier studies examining the concept of control, Seeman and Evans (1962) found that hospitalized individuals who felt "powerless" were less likely to seek out health relevant information compared to individuals who felt a sense of control. Subsequent longitudinal research has found lower perceptions of control to be associated with less personal preventive care, poorer self rated health, less optimism regarding positive treatment

outcomes, and more episodes of illness, bed confinement and greater reliance on the physician (Seeman and Seeman, 1983).

More recent research with the construct of mastery has found that it was positively associated with perceived health, so that individuals who perceive they have more control over their lives (i.e., higher perceptions of mastery) and also reported better physical health (Bailis, Segall, Mahon, Chipperfield & Dunn, 2001; Cohen, Kaplan & Salonen, 1999; Marmot et al., 1998) and psychological well being. Yet inconsistent findings have also been reported. For example Cott, Gignac and Badley (1999) found that low perceptions of mastery was associated with increased odds of reporting poorer health, but only for individuals with chronic illness or disability. In persons without chronic illness or disability, mastery was not significantly related to self-rated health status.

Across three studies drawn from national data sets in the United States, Lachman and Weaver (1998) examined the role of multidimensional mastery beliefs (i.e., perceived mastery and personal constraints) on self-rated health. Results demonstrated that higher perceived mastery and lower personal constraints were significantly associated with better self-rated health and life satisfaction after controlling for a sex, age, marital status and income. That is, individuals who reported that they were efficacious in carrying out life's goals and who perceived low levels of external constraints in their lives reported better health and life satisfaction compared to people who had little confidence that they could carry out life goals and who reported more external constraints.

In a nationally representative sample of the United States population (the MIDUS study), Marmot et al. (1998) examined the influence of perceived mastery and personal

constraints on self reported physical health, psychological well-being and self reported waist to hip ratio. Other psychosocial variables such as social support were also examined, but only the results that specifically address perceptions of control will be discussed. Results of the MIDUS study demonstrated that perceived mastery was not significantly related to self-reported physical health, waist to hip ratio or psychological well-being in men and women (Marmot et al.). However, there was a significant relation with personal constraints, with those reporting the highest perceptions of constraints (i.e., low perceptions of control) reporting the worst physical health, highest waist to hip ratios (i.e., body fat), and poor psychological wellbeing in men (odds ratios 4.28, 1.89, 29.7 respectively) and women (odds ratios 4.6, 1.74, 23.7 respectively).

In contrast, some studies have found that high perceptions of control may be associated with poorer health outcomes. Seeman (1991) found that higher levels of mastery (i.e., the unidimensional construct) was an independent predictor of more severe coronary atherosclerosis, suggesting that strong control beliefs may be an independent risk factor for coronary artery disease. A higher sense of control may be especially problematic when "expectations for control are high but opportunities to exercise it are constrained" (Taylor & Seeman, 1999, p.211). Such findings may highlight the importance of contextual factors (Folkman, 1984) and be especially relevant to SES influences on control and health behaviors. For example, individuals from lower SES groups may lack resources (e.g., money) and opportunities (e.g., childcare, safe places to walk) which may be related lower perceptions of control and decrease the likelihood of engaging in health performing behaviors.

Control Beliefs and Health Behaviors

In general individuals who have higher perceptions of control appear to be more likely to engage in healthy lifestyle behavior such as exercise, annual medical check-ups, and breast self-examinations (Ziff, Conrad & Lachman, 1995). However, only a small number of studies have reported relationships between mastery (or other generalized control beliefs) and health behaviors, with mixed results. For example, Leganger and Kraft (2003) found no significant relationship between global control beliefs (operationalized as generalized self-efficacy) and fruit and vegetable consumption. Using data from the National Population Health Survey of Canada, Bailis et al. (2001) found significant positive, albeit relatively weak, correlations between mastery and physical activity status in men and women ($r = .11$ and $r = .14$, respectively). In this study mastery was operationalized as a unidimensional construct, and as such any differential effects of the different components of mastery on health behaviors is unknown.

Self-efficacy has been found to be related to a wide variety of health behaviors and behavioral intentions (Conner & Norman, 1996), including physical activity and exercise behavior (Bandura, 1997; McAuley, Bane & Mihalko, 1995). Both correlational (Dawson, Brawley & Maddux, 2000; Eyler et al., 2003; McAuley & Blissmer, 2000) and prospective (Luszczynska, Mazurkiewicz, Ziegelmann, & Schwarzer, 2007; McAuley, Jerome, Elavsky, Marquex & Ramsey, 2003; McAuley et al., 2007; Rovniak, Andersen, Winett, & Stephens, 2002) research has consistently found self-efficacy for exercise to be an important predictor of physical activity behavior across a variety of populations. Moreover, different types of exercise self-efficacy appear to be differently related to exercise intentions and behavior (Rodgers & Sullivan, 2001; Rodgers et al., 2002a; 2002b). For example, task-self-efficacy (confidence for performing basic elements of the

task) has been found to be a strong predictor of behavioural intentions, whereas coping self-efficacy (confidence for overcoming challenges related to the behavior) was found to be a strong predictor of actual behaviour (Rodgers & Sullivan; Rodgers et al.).

A series of reviews have demonstrated the efficacy of the theory of planned behavior, and the PBC construct (see Conner & Armitage, 1998; Godin & Kok, 1996). PBC has been found to be related to a variety of intentions and behaviors (Madden, Ellen & Ajzen, 1992; McCaul, Sandgren, O'Neill & Hinsz, 1993; Schifter & Ajzen, 1985) including physical activity and exercise (Armitage, 2005; Blue, 1995; Courneya, 1995; Courneya & McAuley, 1995; Godin, 1993; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997; Kimiecik, 1992; Madden et al.; Norman & Smith, 1995).

In terms of differentiating self-efficacy beliefs from PBC, a body of evidence is accumulating demonstrating support for the distinction between self-efficacy and PBC across a variety of health behaviors (Conner & Armitage, 1998; Dzewaltowski, Noble & Shaw, 1990; McCaul et al., 1993; Povey, Conner, Sparks, James & Shepard, 2000; Rodgers, Conner & Murray, in press-a). While these studies support the discriminant validity of self-efficacy and PBC (Povey et al.), the predictive power and pattern of results differs from study to study, with some studies finding PBC to be a better predictor of intentions and behaviour than self-efficacy (McCaul et al.), others finding self-efficacy to be a better predictor of intentions (Sparks, Guthrie & Shepard, 1997; Trafimow, Sheeran, Conner & Finlay, 2002) and behaviour than PBC (Povey et al.), and yet other studies finding that self-efficacy predicted only intentions (and not behaviour) and that PBC predicted only behaviour, not intentions (Terry & O'Leary, 1995).

Mixed findings also have been found when specifically examining physical activity behaviour. A number of studies have shown that self-efficacy beliefs are more strongly related to exercise behavior than PBC (Dzewaltowski et al., 1990; Rodgers et al., in press-a, Rhodes & Courneya, 2003) For example in a prospective study, Dzewaltowski et al. found self-efficacy to be a significant statistical predictor physical activity behaviour, but not PBC. In a series of studies, Rodgers et al. found that self-efficacy was a stronger predictor of exercise behavior than control or difficulty beliefs. Rhodes and Courneya examined the association between self-efficacy, controllability or a common factor (comprised of both efficacy and controllability) on exercise intentions and behaviour in a sample of undergraduate students and cancer survivors. Results demonstrated that in both groups self- efficacy alone was a stronger correlate of behavioural intentions, not controllability or a common factor. However, in the student group, no type of perceived control (i.e., self-efficacy, controllability or common factor) had a significant effect on exercise behaviour, while in the group of cancer survivors, the best predictor of behaviour was the common factor perceived control.

Other research has shown that PBC, not self-efficacy, to be significant positive predictor of exercise behaviour (Terry & O'Leary, 1995). For example, PBC was found to moderate the relationship between intentions and behaviour, suggesting that individuals are more likely to behave in line with their intentions when they perceive the behaviour to be under their control (Terry & O'Leary). This is an important finding, as it suggests that for behaviours that are not under complete volitional control, being motivated to perform the behaviour may not be sufficient to produce a behavioural response (Terry & O'Leary).

In a study examining physical activity levels in adolescent girls, researchers compared the roles of PBC and barrier self-efficacy in predicting physical activity behavior across a one year time period (Motl, Dishamn, Ward, Saunders, Dowda et al., 2005). PBC was conceptualized as the ease or difficulty of being physically active (e.g., "I believe I have all the things I need to be physically active during my free time on most days") and self-efficacy was conceptualized as confidence in one's ability to be physically active against a variety of challenges, such as weather (Motl, Dishman, Trost, Saunders, Dowda, Felton et al., 2000). Results showed that self-efficacy and PBC had unique and independent relationships with physical activity. For example, self-efficacy was related to initial levels of moderate physical activity ($r = .24$), and both self-efficacy and PBC were related to initial levels of vigorous physical activity (r's = .34 and .33 respectively). However, only PBC predicted changes ($\beta = .15$) in vigorous physical activity across a one year time period. Furthermore, results demonstrated that self-efficacy and PBC were not redundant in explaining physical activity behavior in young women (Motl et al., 2005).

The results of two meta-analyses provide additional support for the distinction of self-efficacy and PBC, and support the importance of both constructs across a variety of behaviors including physical activity (Armitage & Conner, 2001; Hagger et al., 2002). For example, in a meta analysis of 161 studies, Armitage and Conner examined the roles of self-efficacy, PBC, and perceived control over behavior across a variety of behaviors. Self-efficacy was defined as confidence in one's ability to perform a specific behavior. PBC was defined as perceived ease or difficulty of performing the behavior. Perceived control over behavior was defined as 'perceived controllability of behavior' (e.g.,

"whether or not I do X is up to me"). Self-efficacy and PBC had similar correlations with intention (r's = .44) and behavior (r = .35 and r = .40, respectively). The relationship between perceived control over behavior and intention (r = .23) and behavior (r = .18) was weaker. Further, self-efficacy added a unique 7% of the variance to the prediction of intention and 2% to behavior. PBC added a unique 5% of the variance to the prediction of intention and 2% to behavior. Perceived control over behavior added less than 1% of the variance to behavior and approximately 1% of the variance to intention. Measures of self-efficacy and PBC showed stronger associations to intention and behavior than measures of perceived control over behavior, suggesting that both PBC and self-efficacy were both useful predictors of intention and behavior (Armitage & Conner).

In a meta analysis of 72 studies in the physical activity domain, Hagger et al. (2002) examined the relationships between TPB variables, including an examination of PBC and self efficacy in relation to intentions and behavior. Results demonstrated that PBC had direct effects on both physical activity behaviour (β = .15) and intentions (β = .33). Similarly, self-efficacy had unique direct effects on physical activity behaviour (β = .15) and intentions (β = .28). Including all TPB variables (i.e., attitudes, subjective norms, PBC), PBC, along with attitudes, were found to be the best predictors of behavioral intentions. Both self-efficacy and PBC had a similar impact on physical activity behaviour. However, operational definitions of what constituted PBC and self-efficacy in the meta analysis were not clearly stated, so it is not clear what types of items (e.g., confidence, easy/difficult) reflected self-efficacy and PBC.

Results of meta-analyses and previous research seem to indicate that both self-efficacy and PBC may be important differential predictors of intentions and behavior,

with some studies reporting stronger effects of self-efficacy on behavior and other studies reporting stronger effects of PBC on behavior. Differential effects of self-efficacy and PBC may vary as a function of the behavior studied (Armitage & Conner, 2001). Certain behaviors may be more heavily influenced by perceptions of ease or difficulty of performing the behavior, degree of confidence, or the extent to which resources or opportunities are believed to be available.

The way in which researchers differently defined and operationalized self-efficacy and PBC may help explain mixed results and can make interpretation difficult. Overall, self-efficacy seems to be more clearly defined and operationalized compared to PBC, which tends to consist of a variety of mixed measures (Armitage & Conner, 2001). For example, self-efficacy has been most frequently operationalized as confidence for participating in a specific activity against a variety of barriers (Dzewaltowski et al., 1990; Motl et al., 2005; Rhodes & Courneya, 2003), similar to Bandura's (1991; 1997) conceptualization. However, it has also been operationalized as the extent to which participating in a behavior would be "easy or difficult" (Terry and O'Leary, 1995) and the extent of the likelihood one could perform a behavior (McCaul et al., 1993). PBC has been operationalized as the extent to which engaging in a given behavior would be "under your control", "up to you", "likely" or some combination of all three (Dzewaltowski et al.; Rhodes & Courneya; Terry & O'Leary), the extent to which one believes he/she has adequate resources and opportunities (Motl et al., 2005), and the likelihood of successfully performing a given behavior (McCaul et al.).

The distinction between different kinds of control (e.g., mastery, self-efficacy, PBC) may be important as they each may be differentially related to health and health

behaviors (Marmot et al., 1998; Terry & O'Leary, 1995). Further, even with regard to the same health behavior, under certain conditions different control beliefs may be more (or less) important in determining behavioral performance. For example, for people with limited financial resources, personal constraints (belief in the existence of external constraints) may be a stronger correlate of physical activity behavior than perceived mastery or efficacy beliefs. Thus, while conceptually and empirically researchers have been able to identify multiple facets of perceived control, few studies have examined how perceived control functions in relationship to other resources for health and health behaviors (Bailis et al., 2001). One such other resource is an individual's socioeconomic status.

Socioeconomic Status

Socioeconomic status (SES) has been used as an explanatory variable in health research, with research typically examining the extent to which SES is related to health, or with research controlling for SES when examining other correlates of health (Braveman, Cubbin, Egerter, Chideya, Marchi, Metzzler et al. 2005; Oakes & Rossi, 2003). Despite the importance and growing interest of SES in health research, relatively little attention has been paid to the conceptualization and measurement of SES, especially in North America (Krieger, Williams & Moss, 1997; Oakes & Rossi). Almost no research exists on how to best operationalize SES itself, there is no consensus on a nominal definition, and a widely accepted measurement tool is nonexistent (Oakes & Rossi). Further, within the literature it is acknowledged that "there is no single best indicator of socioeconomic status" (Galobardes, Shaw, Lawlor, Lynch & Davey Smith, 2006a, p.7). Oakes and Rossi state that, "conceptualizing and measuring SES is among the more

difficult and controversial subjects in social science research. Prominent scholars have debated the theory, operationalization and usefulness of SES for about 125 years" (p.770).

In part, the way in which SES has been operationalized in previous studies is dependent on where the research is coming from. For example, societies with more rigid class systems than North America, such as Britain, have conducted the largest amount of research on social stratification and health. The majority of the descriptive research on social status and health is British, and nearly all it uses occupational status as the indicator of SES (House & Mortimer, 1990). In North American research, SES has been primarily operationalized by educational attainment and level of income (Oakes & Rossi, 2003). Overall, commonly used measures of SES in epidemiologic studies include occupation, education and/or income (Lynch & Kaplan, 2000).

Despite the ongoing debate on how to conceptualize and operationalize SES, there needs to be some conceptual clarity about what the socioeconomic parameters are that we are measuring (Krieger et al., 1997). While a distinction often made in the literature is between social class, social status and SES (Krieger et al.; Williams, 1990), these terms also tend to be used interchangeably. This has lead some researchers (e.g., Krieger et al.) to argue against the use of the term SES itself, stating that it blurs the distinction between different aspects of social stratification on health: socio-economic position (e.g., actual resources such as income) and prestige related characteristics (i.e., status). Krieger et al. argue that the term socioeconomic position (SEP) be used instead of SES. However, by Krieger et al's definition, SEP refers to both resource based measures and prestige (or status) based measures as linked to social class position. Therefore, it seems that

conceptual clarity may be still be lacking. For the purposes for this paper, the term SES will be used to describe aspects of social stratification relevant to developed countries, namely income, education, occupation and subjective social status. The term SES (instead of SEP) was chosen because the majority of research examining social stratification in relationship to health uses the term SES. Thus, at least some consistency will be maintained with how social inequalities in health have been described in previous research studies.

The term SES has been used to "describe inequality in ranking that exists in society" (Williams, 1990, p. 83) and to refer to "an individual's relative position in the social hierarchy" (Mackenbach & Kunst, 1997). Measures of SES indicate particular structural positions. These positions are considered powerful determinants of the probability of exposure to health damaging and possession of health enhancing resources (Lynch & Kaplan, 2000). Education, income and occupation have been viewed as important objective and *distinctive* dimensions of social stratification (House, & Mortimer, 1990; Williams) and SES has been most commonly operationalized by education, income and/or occupation position (Mackenbach & Kunst; Oakes & Rossi, 2003; Siegrist & Marmot, 2004). While indictors of SES are often correlated, it is important to note that each indicator of SES may differently influence health and health behavior (Krieger et al., 1997). Thus income, education and occupation are not necessarily 'interchangeable' (Grundy & Holt, 2001). Further, the use of composite scores of SES (or overall SES indices) is not common in health research, and as such composite measures of SES have not been systematically evaluated or validated in health research (Kreiger et al.).

Income

It is well known that income is important for health (Veenstra, 2003). At the level of the individual, income has been found to be related to health status within many Western countries, including the United States (Franks, Gold & Fiscella, 2003) and Canada (Denton & Walters, 1999; Humphries & van Doorslaer, 2000; Veenstra, 2000 Wolfson, Rowe, Gentleman & Tomiak, 1993). Income is used as an indicator of material resources (Galobrades et al., 2006; Siegrist & Marmot, 2004), and while it is unlikely that money itself directly affects health (Galborades et al.), it is thought to relate directly to the material conditions that can influence health (Lynch & Kaplan, 2000). Adequate income has important implications for a range of material circumstances including location of housing, food, clothing, transportation, opportunities for cultural, recreational and physical activities, and child care (Lynch & Kaplan).

Income can be a complex variable, consisting of wage earnings, child support, dividends, interest, alimony, transfer payments and pensions (Krieger et al., 1997). Household income is typically assessed more often than individual income in health research, as it is a more useful indicator for people who are not the main earners of the household, typically women (Galobrades et al., 2006). Although income has a cumulative effect over the life course and is the indicator of SES that can change most on a short term basis (Galobardes et al.), health research typically measures income at one point in time with a single item (Galobardes et al; Lynch & Kaplan).

When measuring income in research, people are asked to report their absolute income or are asked or place themselves within predefined income categories (Galobrades et al.). The categorical approach to measuring income is more common

because people are hesitant to provide exact income information (or they don't know it) and are more comfortable responding to their placement in categories (Stewart, 2002). The income categories used in health research are often determined by the researcher, which reduces comparability across studies, since the ranges of income categories used varies extensively (Stewart). Alternatively, some research studies analyze data collected by other organizations. For example, within Canada, Health Canada, through the National Population Health Survey (NPHS), collects data on health, health behaviors and SES (among other things).This data is then used by researchers examining links between various indicators of SES and health status (e.g., Bailis et al., 2001; Humphries & van Doorslaer, 2000; Kosteniuk & Dickinson, 2003;) and health behaviors, including physical activity (Gauvin, 2003). Within the NPHS, household income data are collected with 11 income categories ranging from no income thru to $80, 000 or greater. Consequently, published data on the health of Canadians related to income uses these income categories as most (Canadian) data appears to come from the NHPS.

For income information to be comparable across household, information on number of persons supported by income (family or household size) needs to be considered. For example, two families may each have a household income of $100, 000, but if one is a family of four and the other is a family of two, the two household cannot be adequately compared in terms of level of income. Adjusting income levels for household size is not often done in health research (Krieger et al), however doing so assumes that a family of four would have needs that would approximately be double the income of a single person to have a similar standard of living (Humphries & van Doorslaer, 2000) .

Data on income can also be collected at the neighborhood level, and this has typically been done using zip (postal) codes, or census tract, block or electoral ward data (Krieger et al., 1997; Picket & Pearl, 2001). However, measuring neighborhood level SES can be problematic. Picket and Pearl argue that it can be difficult to operationalize the neighborhood itself. For example, zip or postal codes often include multiple neighborhoods, and potentially neighborhoods that differ socioeconomically can have the same postal code (Krieger et al.). Further, in order to isolate the effects of neighborhood SES, individual level SES must be controlled for in analyses, otherwise neighborhood level effects may act as a proxy for individual aspects of SES (Picket & Pearl).

It has been suggested that neighborhood levels of SES are more important determinants of health in the United States and Great Britain than in Canada (Ross, Wolfson, Dunn, Berthelot, Kaplan, & Lynch, 2000; Mackenbach, 2002). For example, in the United States, a strong inverse association was found between age-adjusted all cause mortality risk and neighborhood level income in black and white men (Davey Smith, Neaton, Wentworth, Stamler & Stamler, 1996a; Davey Smith, Wentworth, Neaton, Stamler & Stamler, 1996b). However, data from Canada suggest that individual based measures of household income are better predictors of self-report health status (McLeod, Lavis, Mustard, & Stoddart, 2003) and mortality (Roos, Mangoon, Gupta, Chateau & Veugelers, 2004; Veugelers, Yip & Kephart, 2001) than neighborhood SES characteristics (e.g., neighborhood household income, education level, unemployment rate). For example, Veugelers et al. found that neighborhood SES characteristics were not associated with mortality, although individual SES characteristics were. Perhaps neighborhood level SES is a weaker indicator in Canada compared to other countries

because of differences in the greater social milieu such as income inequality, access to health care and social services and to public schools, and crime rates (Veugelers et al.).

Overall, income is considered the best single indicator of material living standards (Galobrades et al., 2006) and it is thought to be the component of SES that is most amenable to change through redistributive policies (e.g., tax credits, income supplementation). However, there are limitations to using income as an indicator of SES. Obtaining information on income is considered to be sensitive and as such people may be hesitant to provide the information (Galobrades et al.), although Dorling (1999) argues that this has been overstated. Income is age dependent, and as such may be a less reliable indicator of SES in younger and older people (Galobardes et al). Further, compared to education and occupation, income is sensitive to changes in life circumstances and income measures generally do not include money earned from informal economies, such as inherited wealth, benefits, ownership of certain properties etc (Stewart).

Education

Educational attainment is widely acknowledged as a key component of SES (Galobardes et al., 2006; Liberatos, Link & Kelsey, 1988). A formal education experience involves gathering facts, learning a variety of concepts, and finding out how to access information, potentially providing a set of cognitive resources that may influence health (Lynch & Kaplan, 2000). Ross and Wu (1995) argue that education is the most important aspect of SES in relation health, as it shapes the likelihood of being unemployed, the kind of job one can get, and people's income.

Education is the most widely used indicator of socioeconomic position in US public health research (Krieger et al., 1997), and is considered a key indicator of SES by

Health Canada (1999) in determining the health of Canadians. Education can be measured as a continuous variable (years of completed education) or as a categorical variable by assessing important educational achievements, such as completion of high school (Galobardes et al., 2006; Stewart, 2001). Measuring education as a continuous variable assumes that every year of education contributes similarly to a persons SES, and that years of education is more important than specific educational achievements (Galobardes et al.). Measuring education in terms of credentials rather than years of studies assumes that specific achievements are more important in terms of indicating SES. Lynch and Kaplan (2000) argue that credentials or specific educational achievement is the preferable measure, because it is more meaningful to have completed 12th grade than 11th or 10th grade. Having a high school diploma, compared to having completed grade 11, is more meaningful in terms of employment prospects (Krieger et al.). Additionally, in Canada there have been differences by provinces with regard to when students graduated high school. For example, some students may have graduated with a diploma at grade 12, but for others this may have been grade 13.

Education is relatively easy to measure and obtain, applicable to persons not in the labor force (e.g., retired, homemakers and the unemployed), and relatively stable over time (Galobardes et al., 2006; Krieger et al.1997). In addition the collection of education information may be less contentious than other indicators of SES such as income (Galobardes et al.). However, the meaning of educational level can vary for different birth cohorts. For example, there have been changes in educational opportunities for both women and some minority groups which may result in biased education information if participants are from a number of different birth cohorts (Galobardes et al). Another

potential limitation of measuring education is for individuals who have received their education from outside the country of residence, where different indicators of education may have different implications.

Occupation

Occupation or work is considered a key structural link between education and income (Lynch & Kaplan, 2000). Educational experiences are responsible for determining what types of employment are available and employment then determines the amount of economic return (Lynch & Kaplan). Occupation based scales are available in Europe and Britain to help determine occupational status (Institute of Medicine, 2001). For example, in Britain occupational status has been determined by the Registrar General's classification of occupation which categorizes occupation by status and level of responsibility, in the end producing six occupational classes (Marmot, Bobak & Davey Smith, 1995).

Health studies in the United States rarely measure occupation (Braveman et al., 2005), and occupational based scales often used in Europe are not commonly used or available in North America (Institute of Medicine, 2001). Thus, other occupational categories have been used in health survey research to help indicate SES. For example, occupational status has included categories for professionals, semi-professionals, managerial, skilled laborers, unskilled laborers, homemakers and persons with no job (Clark, Patrick, Grembowski & Durham, 1995; Grembowski, Patrick, Diehr, Beresford, Kay, & Hecht, 1993). Similarly, the Canadian Census (Statistics Canada, 2001) uses occupational groupings to indicate occupational status. The Population Health Survey, which examined the health of people living in Edmonton, classified occupation by 8

categories, management, professional, technical, administrative/finance, sales/service, trades/transport/equipment operation, farming/forestry/fishing/mining, and processing/manufacturing/utilities (Capital Health, 2002). Health Canada (1999) has used employment status (employed, full-time time, part time, casual, unemployed etc.), as opposed to a classification of occupations, to indicate occupation status.

While conventional occupational categories are included in many national level health surveys in North American research, Braveman et al.(2005) argue that such groupings were not intended to indicate SES, and in fact are not meaningful measures of SES and inadequately measure job related SES characteristics that are thought to affect health. This is because the occupational categories used in North Amercian research included workers with diverse skills, prestige, powers and earnings, whereas in European and British research, the occupational categories are typically based on skills, power, and prestige (Braveman et al.).

Measures of occupational status have been powerful predictors of morbidity and mortality (Marmot, et al., 1995), but there are limitations and criticisms to this approach. In some studies, such as the famous Whitehall studies, occupational status was specific and limited to the study setting, a single employer workforce in one location (Frank et al., 2003). Further, while occupational groupings in North American research can be informative, such categorizations do not necessarily take into consideration important aspects of the job, such as level of responsibility (as done in British research) or job autonomy. It may be that aspects of one's job are more important than the job category itself, especially in relation both SES (Braveman et al., 2005) and to perceptions of control. For example, people who work in jobs where they are afforded some degree of

autonomy and self-direction may have higher levels of personal control versus people in more authoritarian types of job or working conditions.

Another criticism of using occupational status to indicate SES is that many women have previously been excluded from studies examining relations between occupational status and health because they had no formal occupation (Ross & Wu, 1995). Moreover, occupation based measures are not considered reliable for individuals or groups who are outside the paid labor force, including homemakers, unemployed adults, retired adults, and persons employed in informal or illegal sectors of the economy (Kreiger et al., 1997). The exclusion of people who are not employed or who do not fall into an occupational category or ranking eliminates the most disadvantaged, truncates variation in SES and attenuates the effects of education and income on health (Ross & Wu).

Subjective Social Status

Subjective social status refers to an "individual's perception of his/her place in the socioeconomic structure" (Singh-Manoux, Adler & Marmot, 2003, p.1321), and it has been suggested that subjective social status may reflect a person's social circumstances better than more conventional indicators of SES, such as occupation, income and education (Singh-Manoux et al.). Further, Wilkinson (1999) argues that it is not the absolute level of SES that is important for health in a population, but rather relative social standing. Despite more substantial research examining conventional and objective indicators of SES and health, there is more limited research examining the subjective social status and its correlates (Adler, Epel, Castellazzo & Ickovics, 2000). Most previous work on subjective social status occurred from the 1940's thru to the 1970's and typically

assessed subjective social status by asking people to indicate the social class to which they felt they belonged (e.g., upper, working or middle class) (Adler et al.). More recently, Adler et al. have developed a simple single item measure to assess peoples perceptions of their position within a social hierarchy.

Results from previous studies suggest that people use socioeconomic criteria to assign themselves subjective social status (Singh-Manoux et al., 2003). For example, in regression analysis, the predictors of subjective social status were household income, education, employment grade, satisfaction with standard of living and feelings of financial security. Whereas the first three predictors are considered more standard or conventions measures of SES, the last two predictors (satisfaction with standard of living and feelings of financial security) are thought to reflect an assessment of current and future economic/material circumstances. Therefore, subjective social status is argued to not only reflect current social circumstances, but also those from the persons past and their future (Singh-Manoux et al., 2003). Further, results of their analysis show that assigning subjective social status to oneself is not motivated by psychological bias, as indicated by measures of psychological functioning (e.g., hopelessness, mental health, vigilance, hostility) in regression analysis. Thus, there is no support in their study that a person's psychological status determines their assessment of their social position (Singh-Manoux et al.).

Socioeconomic Status and Health

The link between SES and health is well established; "it is the overwhelmingly significant risk factor for health and wellbeing" (Syme, 2001. p.12). SES differences are found for rates of morbidity and mortality across many diseases and conditions

(Antonovsky, 1967; Illsely & Baker, 1991; Marmot Shipley & Rose, 1984; Pincus, Callahan & Burkhauser, 1987). Individuals higher in the social hierarchy benefit from better health than those below them. This association is found across industrialized nations (Adler, 2001; Adler, Marmot, McEwan & Stewart, 1999; Feinstein, 1993) and irrespective of whether SES is measured as income, education or occupation (Cohen et al., 1999).

This relationship between SES and health is argued to be graded (Adler, 2001). People lower on the social hierarchy have poor health then those on the rung above. Findings from the Whitehall studies examining British civil servants demonstrated that a linear gradient exists between one's job status and their health. In other words, for each increment in SES (in this case occupational grade) there was a corresponding improvement in health (Marmot, Rose, Shipley & Hamilton, 1978; Marmot & Shipley, 1996). Thus, employees who occupied higher occupational grades had better health and lower mortality than those immediately below them (Marmot et al.; Marmot & Shipley). Results of the Whitehall studies suggest that health disparities continue throughout the entire SES strata, including the middle and upper levels of SES (Adler). A gradient between SES and health is also found in other industrialized nations, including the United States (Adler, Boyce, Chesney, Cohen, Folkman, Kahn et al., 1993; Cohen et al.) and Canada (Orpana & Lemyre, 2004), and with other indicators of SES, such as education (Pincus et al., 1987) and income (Pappas, Queen, Hadden, & Fisher, 1993).

While there is consensus that SES affects health, what drives the health inequalities remains open to debate (Frank et al., 2003; Kawachi, Subramanian, & Almeida-Filho, 2002; Macleod & Davey Smith, 2003). The different explanations for

inequalities in health relate to the nature and the shape of the relationship between SES and health, and have implications for the types of interventions that may be considered (MacLeod & Davey Smith). Two explanations are most often discussed in the literature, one being the *material deprivation* hypothesis and the other being *the psychosocial interpretation* (Kawachi et al.) The psychosocial hypothesis is based heavily on the work of Marmot, and in short implies that inequalities in health are, in part, due to the direct and indirect effects of psychosocial factors (Kawachi et al.; Macleod & Davey Smith), such as stress, hostility, depression, social support, and perceived control. Thus, intervention efforts would focus efforts on psychosocial factors to help attenuate the effects of SES on health. The material deprivation hypotheses holds that access to material goods (food, shelter, access to basic services and amenities), in part, explains social class differences in health. Thus, intervention efforts would be targeted towards improving access to tangible resources, housing and so on.

Both the material deprivation and psychosocial explanations are often presented as being competing or mutually exclusive, and there is some evidence for both explanations (Adler, Boyce, Chesney, Cohen, Folkman, Kahn et al., 1994; Backlund, Sorlie, & Johnson, 1996; Ecob & Davey Smith, 1999; Frank, Cohen, Yen, Balfour & Smith, 2003; Marmot, Bosma, Hemingway, Brunner & Standfeld, 1997; Wolfson, Kaplan, Lynch, Ross & Backlund, 1999). However, Kawachi et al. (2002) argue that it is generally not possible to disentangle their effects from one another, as material resources tend to hold psychosocial meanings. For example, home ownership has a material interpretation, but it also holds a psychosocial interpretation, in terms of increased social status. Greater income (a material resource) engenders a sense of control. It is probable

that there are multiple pathways or mechanisms in the SES health relationship and that both material resources and psychosocial factors are important (Singh-Manoux, 2003).

Subjective social status has also been found to be positively related to health, including self-rated health (Adler et al., 2000; Hu, Adler, Goldman, Weinstein & Seeman, 2005; Singh-Manoux et al., 2003; Operario et al., 2004; Ostrove et al., 2000), body fat distribution (Adler et al.), cortisol levels (Adler et al., Wright & Steptoe, 2005), psychological well (Ghaed & Gallo, 2007) and rates of illness (Singh-Manoux et al). Further, the subjective social status appears to impact health beyond traditional measures of SES (Ghaed & Gallo; Singh-Manoux et al.).

Socioeconomic Status and Health Behaviors

SES also plays a significant role in the adoption and maintenance of health behaviors (Emmons, 2000). Behavioral risk factors such as smoking, inactivity and consumption of a high fat diet show a similar graded relationship to SES (Matthews, Kelsey, Meilahn, Kuller & Wing 1989; Winkleby, Cubbin, Ahn, & Kraemer, 1999). For example, greater educational attainment and income have been associated with lower rates of smoking (Cohen et al., 1999), and lower educated smokers are more likely to continue smoking compared to higher educated smokers (Droomers, Schrijvers, & Mackenbach, 2002). Subjective social status has also been associated with health behaviors. Women who perceived themselves lower on a social hierarchy had poorer dietary habits and reported less physical activity (Ghaed & Gallo, 2007).

With regard specifically to physical activity, individuals with lower SES typically report lower levels of physical activity (Eyler et al., 2003; Gauvin, 2003; Iribarren, Leupker, McGovern, Arnett & Blackburn, 1997; US Department of Health and Human

Services, 1996), although the patterns of results differ from study to study. For example, in an economically and geographically diverse sample of residents in the United States, there was no relationship between education and physical activity, but people with lower incomes were less likely to be active than those with higher incomes (Parks, Housemann & Brownson, 2003). However, greater educational attainment and income have been associated with vigorous physical activity, and duration of physical activity has been positively associated with education (Cohen et al., 1999). In a sample of older adults, individuals with less education were less likely to report walking and participating in a regular exercise routine (Clark, 1995) than individuals with more education. Among Albertans, individuals with more education and higher income were more likely to be active compared to individuals who did not complete high school (Garcia Bengoechea & Spence, 2002; Garcia Bengoechea, Spence, & Fraser 2005).

Occupation and employment status have also been found to be related to physical activity. In a study examining leisure time activity levels in blue-collar (e.g., tradespersons, laborers, machine operators) white-collar (e.g., clerks, salespersons) and professional (e.g., managers, administrators, professionals) employees in a sample of Australians, the highest rates of inactivity were reported by blue-collar workers compared with professionals, although differences between professionals and white-collar workers were not found. Among Albertans, people who were employed (either full or part time) were more likely to be physically active than retired or unemployed persons (Capital Health, 2002; Garcia Bengoechea et al., 2005).

Inconsistent results between SES and physical activity behavior have also been reported. For example, in the Capital Health region of Alberta, there was no consistent

relationship between physical activity and income, and education and physical inactivity were inversely related (Capital Health, 2002). People who had a higher education (university degree) were more likely to be physically *inactive* compared to people with a high school diploma. This may be related to the type of jobs people held. For example, people with professional, administrative and management occupations were more likely to be *inactive* compared to people in trades, farming, manufactures and sales/service occupations. Differences in the relationship among indicators of SES and physical activity in this study may be related to the way in which physical activity was assessed. This study assessed a wide variety of physical activities (vigorous, moderate, walking and sedentary activities) to come up with two categories of activity: insufficient activity or sufficient activity. Thus, aspects of activity at work were captured in the capital health survey, not simply leisure time or single item indicators of physical activity. It is possible that people with less education may have more physical jobs and thus may be more active at work than people who have more sedentary jobs.

In general, however, research suggests that those with higher SES are more likely to have better health and report engaging in health promoting behaviors. It is not clear as to why those with higher SES are more likely to have better health and engage in more health promoting behaviors (Kubzansky, Berkman, Glass, & Seeman, 1998). Three categories of possible explanations have been offered for the graded association between SES and health status (Adler et al., 1994). The first is that there may be genetically based differences in SES groups. The second, known as the health selection or drift hypothesis, states that illness or poorer health influence SES, as opposed to SES affecting poorer health. The third explanation focuses on SES affecting biological function which in turn

influences health status. Adler et al. argue that while the first two explanations may contribute to the SES-health gradient, they are for the most part implausible. Further, longitudinal research seems to indicate that health selection (drift hypothesis) is not the primary explanation for the social gradient (Power & Hertzman, 1997), and Marmot et al. (1998) have further argued that certain indicators of SES, such as educational attainment, precede the development of ill health in mid life and older individuals, making it difficult to argue that poorer health later in life influenced educational attainment which occurred earlier in life. Rather, Adler et al. argue that indicators of SES, such as income, education and occupation shape ones life, including experiences that influence psychological development and health behaviors (see also Anderson and Armstead, 1995). Thus, SES may influence health and behavior in part through its relation with psychological factors.

The relationship between health behaviors is thought to vary by SES, although the nature of the relationships differs in studies. For example, some researchers have found that the impact of health behaviors (e.g., smoking) on health is more pronounced at lower levels of SES than higher levels of SES (Davey Smith & Shipley, 1991; Marmot, Shipley & Rose, 1984) and other researchers have found that health behaviors had a similar influence on health for both lower and higher SES groups (Kooiker & Christiansen, 1995; Williamson, 2000). Moreover, although Williamson has suggested that the relationship between individual health behaviors and health may be dependent on adequate levels of income, she found no evidence for this in a large sample of Canadians.

The experiences of individuals at different levels of SES are likely different. For example, individuals at lower income levels and with less education may have fewer opportunities to influence events that affect their lives compared to people with higher

income and more education (Lachman & Weaver, 1998). Thus, there may be differences in perceptions of control at different levels of SES, with higher SES individuals more likely to report greater perceptions of control (Bailis et al., 2001; Cohen et al., 1999; Kubzansky et al.,1998; Lachman & Weaver; Marmot et al., 1997; Pearlin et al., 1981). Positive perceptions of control in general could influence other aspects of people's lives, including participation in health promoting behaviours.

Control Beliefs and Socioeconomic Status

Research has shown that there is a positive relationship between SES and a wide variety of control beliefs, including perceptions of mastery (Bailis et al., 2001; Cohen et al., 1999; Kubzansky et al., 1998; Lachman & Weaver, 1998; Pearlin et al., 1981) and self-efficacy (Clark et al., 1995; Gecas, 1989; Grembowski et al., 1993; Kubzansky et al.). For example, Cohen et al. found that individuals with higher educational attainment and greater income reported higher levels of mastery. In turn, lower perceptions of mastery have been associated with lower educational attainment and less income.

Despite considerable research demonstrating the importance of self-efficacy in predicting exercise behavior, the influence of SES on self-efficacy is rarely examined (Gecas, 1989; Clark, 1996; Clark et al., 1996). In the little research that has been conducted, positive associations between SES (education, income, occupation) and exercise self-efficacy have been found (Clark 1995; Clark et al.; Garcia Bengoechea & Spence, 2002). Education and income levels were found to be positively related to self-efficacy for physical activity in Albertans (Garcia Bengoechea & Spence). In a sample of Type II diabetics, a positive association was found between income and efficacy beliefs surrounding physical activity (Barrett, Plotnikoff, Courneya & Raine, 2007). Skilled

workers and managers had higher exercise self-efficacy than semi-professionals (Clark et al.) suggesting that when occupational categories are used, there may not be a linear association between occupation and self-efficacy for exercise. A physically demanding job, such as one that may comprise being a skilled worker, may increase confidence in one's physical ability (Clark et al.).

Few studies have examined the relationship between SES and PBC (Hagger et al., 2002). Literature examining PBC and health behaviors frequently treat SES as nuisance variable, and statistically control for the effects of SES in analysis. One of the aims of the proposed studies is to understand the links between control beliefs, SES and health behavior. Based on previous research demonstrating that different levels of SES influences generalized and domain specific control beliefs (Cohen et al., 1999), it seems reasonable to expect that SES would similarly influence PBC.

Control Beliefs, Socioeconomic Status and Health

Relatively little research has examined the relationship among indicators of SES *and* control beliefs *and* health status or health behaviors (Leganger & Kraft, 2003). Of the studies that have looked at the relationship among indicators of SES, control beliefs and health/health behaviors, findings suggest that perceptions of control may underlie part of the SES differences in health status (Bailis et al., 2001; Lachman & Weaver, 1998; Marmot et al., 1998) and health promoting behaviors (Leganger & Kraft).

Using cross sectional data from a large study in the United States (N = 960 men and 1427 women), Cohen et al. (1999) examined whether perceived control could explain part of the relationship between SES and self-report health status. Self reported health and perceived control (conceptualized as a generalized control belief) were both assessed

with a single item. SES was indicated by level of education completed and household income. Results demonstrated that higher levels of both income and education were significantly associated with higher perceptions of control. In turn, higher scores on perceived control were significantly associated with less risk of poorer self report health (Odds Ratio = 0.5). When perceived control was co-varied out of the relationship between SES and health status, there was some attenuation of the relationship between SES and health status, with most attenuation occurring at the lowest SES category. Findings provided support for the role of psychological factors as a pathway between SES and health status (Cohen et al.).

Cross sectional data from the National Population Health Survey of Canada (N = 11, 110) also found evidence for the role of control beliefs (i.e., the unidimensional mastery construct) in the relationship among SES and health status (Bailis et al., 2001). Results showed that perceptions mastery mediated the influence of SES (modeled as a single variable accounting for income, employment status and education) on self-rated physical and mental health status in men and women (Bailis et al., 2001). That is, for both men and women, individuals with higher SES reported greater perceptions of mastery (i.e., greater control over life events), and in turn better self-report physical health and psychological functioning compared to individuals with lower SES and control beliefs.

SES differences in the two components of mastery (i.e., perceived mastery and personal constraints) were examined in men and women across 3 different data sets from U.S. samples (Lachman & Weaver, 1998). Specifically, researchers examined the relationship between income and control beliefs across indicators of psychological well-being (i.e., depressive symptoms, life satisfaction) and self rated health status. Overall,

Lachman and Weaver found that people in lower income groups reported lower levels of perceived mastery and higher levels of personal constraints. Further, those with higher perceived mastery and lower personal constraints reported better life satisfaction and health status, and lower depression. SES differences in measures of health status were reduced by high perceptions of mastery and low levels of personal constraints (Lachman & Weaver). In particular, personal constraints showed a stronger association to health status than perceived mastery.

Control Beliefs, Socioeconomic Status and Health Behaviors

The results of a handful of studies to date suggest that control beliefs may play a role in relationship between SES and health status. However, health behaviors have demonstrated a similar relationship to SES (Matthews et al., 1989; Winkleby et al., 1999), and it seems reasonable to suggest that control beliefs may also play a role in the relationship between SES and health behaviors. Understanding how different social and contextual factors influence different types of control may be important as within different contexts, different types of control may be differently related to health behavior. However, little research has examined the relationship among control beliefs, SES and health behaviors (Sheeran & Abraham, 1996), including physical activity and exercise behavior.

Some studies have found that control beliefs partially mediate the relationship between SES and health behaviors. For example, Legagner and Kraft (2003) examined whether control beliefs mediated the relationship between educational attainment and fruit and vegetable intentions and behavior in women (N = 329) from Norway. Specific control beliefs examined were health locus of control, specific response efficacy (e.g.,

"consuming fruits/vegetables at least three times a day will…reduce my risk of getting cancer), generalized self-efficacy (e.g., "I can solve most of the problems if I invest the necessary effort") and specific self-efficacy expectancies (e.g., "I am confident that I can consume fruits/vegetables at least three times a day….even if I am busy"). Results showed that generalized self-efficacy (path coefficient = .21), chance locus of control (path coefficient = -.24) and specific response efficacy (path coefficient = .13) partially mediated the influence of education on intentions. Education also influenced intentions and behavior directly (Leganger & Kraft). All the effect of the control constructs on behavior was mediated through intentions. Overall, education, control beliefs and intentions explained 44% of the variance in behavior and 28% of the variance in intentions.

Summary of the Research

There is little doubt that perceptions of control are important in terms of health and health behaviors. Conceptually and theoretically each type of control (e.g., mastery, self-efficacy, PBC) are thought to be distinct. However, it is necessary to empirically establish the independence and of each of the constructs with regard to exercise behavior. The majority of the research examining whether control constructs are distinct from each other has occurred between self-efficacy and PBC. Mastery has seldom been examined with other constructs of control, and with specific health behaviors, including exercise. Schieman (2003) argues that in order to better understand "individuals' awareness, desires, and decisions about control type behavior within domains, we should consider the generalized control orientation that one brings to various situations" (p.74)

Different factors such as social and economic factors may be related to perceptions of control, which may in turn influence exercise behavior. For example, individuals with greater income likely possess greater economic resources, which may afford them with advantageous resources and opportunities and engender a stronger sense of control, which in turn may positively influence participation in specific health behaviors. However, individuals with lower income likely have fewer economic resources and fewer and opportunities to engage in health behaviors. Within this context, the belief that there are factors beyond personal control (e.g., personal constraints) may be a particularly important predictor of behavior. While previous research has examined the relationship among SES and health behaviours, SES and control beliefs, and control beliefs and health behaviours, very few studies have examined the relationship among SES, control beliefs and health behaviours to each other. That is, two separate bodies of research demonstrate the importance of both perceptions of control (Bandura, 1997; Courneya, 1995; Courneya & McAuley, 1995; Godin, 1993; McAuley et al., 1995; Rodgers & Sullivan, 2000; Rodgers et al., 2002a; 2002b) and SES (Cohen et al., 1999; Matthews et al., 1989; Winkleby et al., 1999) on physical activity and exercise behavior, but the relationship between social cognitive factors, indicators of SES and physical activity/exercise behavior to each other *within the same study* has received little attention (Leganger & Kraft, 2003).

Therefore, the purpose of the two dissertation studies was to examine the association between SES, control beliefs and exercise behavior. The first study examined the relationship between indications of SES (income, education, occupation and subjective social status), control beliefs (mastery, self-efficacy and PBC) and moderate

effort exercise behavior and intentions in a sample of adults living in the City of Edmonton. More specifically, Study 1 first explored whether mastery, self-efficacy and PBC were psychometrically distinct constructs. It then examined whether control beliefs mediated the association between SES and intentions and SES and behavior. The second study examined the relationship between SES (income, education and social status) and control beliefs (control over a heart problem, self-efficacy and PBC) on moderate effort exercise behavior during and one month after attending rehabilitation in a sample of cardiac patients.

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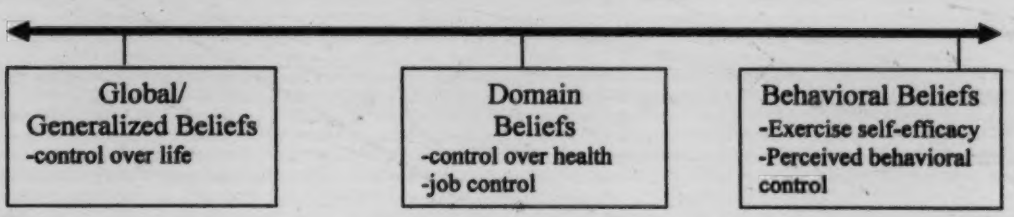
Figure 1-1. Continuum of control beliefs by specificity



2. STUDY ONE

The influence of control beliefs on exercise intentions and behavior: Considering the role of socioeconomic status.

Perceptions of control have important consequences for health and health behaviors (Skinner, 1995; 1996; Steptoe & Wardle, 2001). Control beliefs are positively associated with socioeconomic status (SES; Bailis, Segall, Mahon, Chipperfield, & Dunn, 2001; Clark, Patrick. Grembowski, & Durham, 1995; Gecas, 1989; Kubzansky, Berkman, Glass, & Seeman, 1998; Lachman & Weaver, 1998a; Pearlin, Menagahan, Lieberman & Mullan, 1981), a key determinant of health and health behaviors (Cohen, Kaplan & Salonen, 1999; Emmons, 2000; Health Canada, 1999; Syme, 2001; U.S. Department of Health and Human Services, 1996; Winkleby, Cubbin, Ahn, & Kraemer, 1999). Control beliefs are also central in many modern health behavior theories (e.g., Social Cognitive Theory, Health Belief Model, Theory of Planned Behavior), which have in common some aspect of control as an influence on behavior (Conner & Norman, 1996). However, there is considerable heterogeneity among the constructs researchers use to denote control (Skinner, 1995), and the extent to which control related constructs are distinct has become an important issue (Skinner, 1996; Trafimow, Sheeran, Conner & Finlay, 2002; Rodgers, Conner & Murray, in press-a), as different control beliefs may be differently related to behavioral intentions and behavior. Further, it is possible that within different circumstances (e.g., low income), different control constructs may be more or less important in determining behavioral performance.

There are many ways in which control beliefs can be conceptualized and operationalized (Skinner, 1996). One way in which control constructs are distinguished

from each other is by whether they are 'control beliefs' or capacity beliefs (Skinner, 1995). Control beliefs refer to the extent to which one can produce or prevent desired or undesired outcomes or behaviors (e.g., "I have control over important events in my life'). Capacity beliefs refer to beliefs about whether a particular response (e.g., competency judgments) is in one's repertoire, (e.g., I am confident that I can exercise 4 days a week), and also can include whether one has access to other means, including various resources. Control beliefs can also be distinguished by their specificity. For example, control beliefs can be distal or global, spanning areas of life. In health research, the extent to which life chances or important life events in general are under one's personal control, termed perceived mastery (Adler & Snibbe, 2003; Lachman & Weaver, 1998a; Pearlin & Schooler, 1978), has received considerable attention. Control beliefs can also be proximal, relevant to specific behaviors or situations. In behavioral research, perceptions of control over a specific behavior (e.g., self-efficacy beliefs, perceived behavioral control) have figured prominently.

Types of Perceived Control

Mastery is considered a distal or generalized form of control (Schieman, 2003), and refers to the extent to which people see themselves as being in control of important factors that affect their lives (Pearlin & Schooler, 1978; Pearlin, Menaghan, Lieberman & Mullan, 1981). Some researchers (Lachman & Weaver, 1998a; Marmot et al., 1998) have distinguished between two components of mastery beliefs, namely *perceived mastery* (e.g., the belief that one can control important areas of their life) and *personal constraints* (e.g., the extent one believes that there are obstacles or factors beyond one's control that interfere with reaching goals). Thus, mastery beliefs can also be conceptualized as

multidimensional. According to Skinner, mastery beliefs as described here would be conceptualized as a control belief.

Self-efficacy and perceived behavioral control (PBC) are more proximal or behavioral specific control beliefs. Self-efficacy refers to "beliefs in one's capabilities to organize and execute courses of action required to produce given levels of attainment" (Bandura, 2000, p. 300), and different types of self-efficacy, such as task and coping self-efficacy have also been distinguished in the literature (Maddux, 1995). Task self-efficacy refers to an individuals' confidence to perform elemental aspects of the task whereas coping self-efficacy refers to an individual's confidence to perform the given behavior under challenging conditions. Rodgers and colleagues (Rodgers, Wilson, Hall, Fraser & Murray, in press-b; Rodgers & Sullivan; 2001; Rodgers, Hall, Blanchard, McAuley & Munroe, 2002a) include scheduling self-efficacy (an individuals' confidence to organize and schedule regular exercise) as an important component of coping self-efficacy for exercise behavior. Thus self-efficacy also can be conceptualized as being multidimensional. Accoridng to Skinner's (1995; 1996) framework, self-efficacy beliefs would be conceptualized as capacity beliefs.

PBC refers to " people's expectations regarding the degree to which they are capable of performing a given behavior, the extent to which they have the requisite resources, and believe they can overcome whatever obstacles they may encounter" (Ajzen, 2002a, p. 677). However, Ajzen (1991) has previously described PBC as being analogous to self-efficacy, which has lead to some conceptual overlap (with self-efficacy) in the operationalization of PBC. Ajzen (2002b) later describes PBC as containing two lower order constructs, controllability and self-efficacy, and reviews of the literature

suggest that two components can be distinguished across behaviors (Trafimow et al., 2002), but not all investigators agree. Rhodes and colleagues (Rhodes & Blanchard, 2006; Rhodes, & Courneya, 2003; 2004) have shown across several studies that simple direct measures of PBC were preferable when compared to multiple component measures. Thus, there is a general lack of clarity with regard to the PBC construct (Conner & Armitage, 1998), and it is not clear if PBC is separate from self-efficacy or has multiple components. According to Skinner's (1995; 1996) framework, PBC would also be conceptualized as a capacity belief.

Findings generally show a positive association between a sense of control and health and well-being (Bailis et al., 2001; Bandura, 1997; Cohen et al., 1999; Lachman & Weaver 1998; Marmot et al., 1998; Rodin & Salovey, 1989; Skinner, 1995). However, the association between control beliefs and specific health behaviors like exercise may depend on the domain specificity of the construct (i.e., global and behavioral specific beliefs). For example, studies that have examined the relationship between global control beliefs (e.g., mastery) and health behaviors have produced mixed results. Leganger and Kraft (2003) found no significant relationship between global control beliefs and fruit and vegetable consumption. Bailis et al. (2001) found no association among mastery beliefs and smoking. However, positive associations were found between mastery beliefs and physical activity (Bailis et al.; Ziff, Conrad & Lachman, 1995), medical check-ups, and screening behavior (Ziff et al.), as well as abstinence from alcohol consumption (Bailis et al.).

Behavioral specific control beliefs like self-efficacy (Bandura, 1997; Conner & Norman, 1996) and PBC (Madden, Ellen & Ajzen, 1992; McCaul, Sandgren, O'Neill &

Hinsz, 1993; Schifter & Ajzen, 1985; Schlegel et al., 1990) generally show more robust associations to health behaviors and behavioral intentions than global control beliefs. Both correlational (Dawson, Brawley & Maddux, 2000; Eyler et al., 2003; McAuley & Blissmer, 2000) and prospective (McAuley et al., 2007; McAuley, Jerome, Elavsky, Marquex & Ramsey, 2003; Rovniak, Andersen, Winett, & Stephens, 2002) research has consistently found self-efficacy for exercise to be an important predictor of physical activity behavior across a variety of populations. Similarly, PBC has been found to be a key predictor of both physical activity intentions and behavior (Armitage, 2005; Blue, 1995; Courneya, 1995; Courneya & McAuley, 1995; Godin, 1993; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997; Kimiecik, 1992; Madden et al.; Norman & Smith, 1995).

In terms of differentiating self-efficacy beliefs from PBC, a body of evidence is accumulating demonstrating support for the distinction between self-efficacy and PBC across a variety of health behaviors, including exercise (Conner & Armitage, 1998; Dzewaltowski, Noble & Shaw, 1990; McCaul et al., 1993; Motl et al., 2005; Povey, Conner, Sparks, James & Shepard, 2000, Terry & O'Leary, 1995). Further, the results of two meta-analyses provide additional support for the distinction of self-efficacy and PBC, and suggest that both PBC and self-efficacy were useful, independent predictors of intention and behavior (Armitage & Conner, 2001; Hagger et al., 2002). However, it should be noted that while it appears researchers are able to differentiate between self-efficacy and PBC, there is little conclusive evidence that supports a clear pattern of prediction for self-efficacy and PBC on intention and behavior (Hagger & Chatzisarantis, 2005).

For example, in a series of studies examining the conceptual and empirical distinction of self-efficacy, perceived control and perceived difficulty, Rodgers et al. (in press-a) found support for the distinction among control beliefs and also showed that self-efficacy was a better predictor of health behaviors and intentions, including exercise. Similarly, Dzewaltowski et al. (1990) found that self-efficacy and not PBC was a significant predictor of exercise behavior. However, Terry and O'Leary (1995) found PBC and not self-efficacy to be a significant predictor of behavior. Similar to the results of both meta-analyses (Armitage & Conner, 2001; Hagger et al., 2002), Motl et al. (2005) found that both self-efficacy and PBC had associations with exercise behavior that were similar in magnitude.

In part, mixed findings may be the result of the way in which researchers have defined and operationalized self-efficacy and PBC. Overall, self-efficacy seems to be more clearly defined and operationalized compared to PBC (Armitage & Conner, 2001). For instance, self-efficacy has been most frequently operationalized as *confidence* for participating in a specific activity (Dzewaltowski et al., 1990; Motl et al., 2005; Rhodes & Courneya, 2003). PBC has been operationalized with more mixed measures (Armitage & Conner), including the extent to which engaging in a behavior would be "easy/difficult", "under your control", "up to you", "likely" or some combination of all three (Ajzen, 2002b; Dzewaltowski et al.; Rhodes & Courneya; Terry & O'Leary), the extent to which one believes they have adequate resources and opportunities (Motl et al., 2005), and the likelihood of successfully performing a given behavior (McCaul et al., 1993).

Distinguishing between the different control beliefs (e.g., mastery, self-efficacy, PBC) is important as they each may be differentially related to health behaviors (Rodgers et al., in press-a; Terry & O'Leary, 1995). Certain behaviors may be more heavily influenced by perceptions of ease or difficulty of performing the behavior, degree of confidence, or the extent to which resources or opportunities are believed to be available. Moreover, even within a specific domain (e.g., mastery beliefs), the association may depend on the specific dimension or component of mastery, such as perceived mastery or personal constraints. For example, Marmot et al. (1998) found only personal constraints, and not perceived mastery, to be associated with health and well being in a representative sample of Americans. More specifically, higher personal constraints (i.e., low perceptions of control) were associated with poor physical and psychological health and high waist to hip ratios. Thus, while conceptually and empirically researchers have been able to identify multiple facets of perceived control, few studies have examined how multiple types of control, including global and behavioral specific beliefs, relate to one another and to exercise behavior.

Additionally, few studies have considered the potential influence of the broader social context of the individual, such as SES, when examining the relationship of control beliefs to exercise behavior. It is well known that individuals with lower SES have poorer health and well-being (Syme, 2001; Cohen et al., 1999; Marmot, Rose, Shipley & Hamilton, 1978), irrespective of whether SES is indicated by income, education or occupation (Cohen et al.). Lower SES has also been associated with poorer adherence to health promoting behaviors (Cohen et al.; Emmons, 2000; Matthews, Kelsey, Meilahn, Kuller & Wing, 1989; Winkleby et al., 1999), including physical activity and exercise

behavior (Cohen et al.; Clark, 1995; Iribarren, Leupker, McGovern, Arnett & Blackburn, 1997; U.S. Department of Health and Human Services, 1996). SES has also been positively associated with control beliefs, including mastery (Bailis et al., 2001; Cohen et al., 1999; Kubzansky et al., 1998; Lachman & Weaver, 1998) and self-efficacy beliefs (Clark et al., 1995; Garcia Bengoechea & Spence, 2002; Gecas, 1989; Grembowski et al., 1993; Kunbzansky et al). People with lower SES may have fewer opportunities to exert control or to influence events that affect their lives, and as such may have a lower sense of personal control (Lachman, 2000; Lachman & Weaver, 1998). In turn, this may negatively influence their participation in health promoting behaviors, including exercise. Such findings may provide important information for intervention programs, as they suggest that programs designed to enhance perceptions of control may help to reduce the impact of inequality (i.e., low SES) on health behaviors (Bailis et al.; Lachman & Weaver).

Few studies have examined the relationship among SES, control beliefs, and health behaviors, including exercise, together in the same study (Leganger & Kraft, 2003). In a cross sectional study examining intentions to stop smoking, Droomers, Schrijvers and Mackenbach (2004) found that participants with higher educational attainment were more likely to have higher self-efficacy to quit smoking. However, no educational differences were found in participant's intention to quit smoking. In studies examining nutrition behavior (e.g., fruit and vegetable consumption), SES was found to have a direct effect on nutrition behavior, independent of self-efficacy (Anderson, Winnett & Wojcik, 2000), and in another study control beliefs partially mediated the effect of education on intentions and behavior (Leganger & Kraft, 2003). While the effect

of education was weakened after control beliefs were included in the model, it continued to have direct effects of both intentions and behavior (Leganger & Kraft).

Further, different control beliefs may be more (or less) important in determining behavioral performance in individuals with lower SES. For example, for people with lower incomes, perceiving that they have few barriers in their life (i.e., personal constraints) and that they have the resources and opportunities to be active (i.e., PBC) may be more strongly associated with behavior than their confidence that they can perform the behavior (i.e., self-efficacy). This may have implications for future intervention research, as it might inform researchers of which *kind* of control (e.g., mastery, constraints, self-efficacy for exercise) to focus intervention efforts on.

In summary, mastery, self-efficacy and PBC appear to play an important role in health and health behavior. While conceptually these constructs are distinct, there is a need to determine if they are empirically separable constructs or whether individuals interpret them in a similar fashion, and thus are overlapping constructs. Further, very few studies have examined the relationship among SES, control beliefs and behaviors to each other. That is, separate bodies of research demonstrate the importance of control beliefs *and* SES on intentions and behavior, but the relationship among control beliefs and SES and intentions and behavior *in the same study* has received little attention (Leganger & Kraft, 2003).

Therefore, there were two purposes for this study. The first purpose was to examine whether mastery, self-efficacy and PBC were psychometrically distinct constructs. Based on the results of previous research, and on the conceptualization of control beliefs in this study, it was hypothesized that mastery, self-efficacy and PBC

would form separate constructs. The second purpose of this study was to examine the association among the various indicators of SES, control beliefs and exercise intentions and behavior. It was hypothesized that higher perceptions of control would be associated with higher SES and greater amounts of exercise, and SES would also be positively associated with exercise behavior. Finally, consistent with most previous research, it was also hypothesized that control beliefs would mediate the relationship between SES and behavior and SES and intentions. Which control beliefs would emerge as the exact mediators was exploratory.

Method

Participants

Data were collected between May 2006 and August 2006 from 351 individuals who resided in the city of Edmonton. Participants included 121 men ranging in age from 19 – 92 years (M =52.87, SD = 16.21) and 229 women ranging in age from 19 – 88 years (M = 46.16, SD = 15.55). The average BMI value of participants was 25.8 (SD = 5.29), and the majority of participants reported being in good health. The demographic characteristics of participants are presented in Table 2-1 and descriptive statistics are presented in Table 2-2.

Measures

Demographic information. Gender (0 = female, 1 = male), age, height, weight, and self reported health status were collected with self-report items. For health, participants were asked "In general would you say your health is," and were provided with the following five response options: (1) poor, (2) fair, (3) good, (4) very good, and

(5) excellent. Participants were also asked whether or not they had any physical conditions which limited how much they could exercise (1= yes, 2 = no).

Income. Household incomewas measured according to total annual household income and household size. The household income measure asked participants, "Which of the following is your best guess of the total income, before taxes and deductions, of all household members from all sources in the past year." This question was followed by 13 income response categories, ranging from *no income* to *$150 000 or more*. This method is similar to the most recent draft of the National Population Health Survey in Canada, and similar measures have been used in previous health research in Canada (Bailis et al., 2001; Gauvin, 2003; Humphries & van Doorslaer, 2000; Kosteniuk & Dickinson, 2003).

To assess household size participants were asked "Including yourself, how many people live at your household?" To adjust for the influence of household size on income, the midpoint of each income category range was divided by the square root of the number of people living in the household (Humphries & van Doorslaer, 2000) to correct for "differences in household size while taking into account economies of scale in household production" (p. 666).

Education. Level of education was measured in terms of credentials using the following categories (Marmot et al., 1998; Ross & Wu, 1995): (1) less than a high school diploma (2) a high school diploma, (3) some college/university but less than an undergraduate degree, (4) at least a college/university degree. A higher score indicates higher educational attainment.

Occupation. Job category was used to indicate occupational status. For job category, participants were asked the following open-ended question, "This next question

is about your current or most recent job. Please tell us your current (or most recent) job title (e.g., teacher, mechanic, salesperson, laborer, manager etc.)". The job titles were then categorized according to the International Standard Classification of Occupations (ISCO-88; International Labor Organization, 2006). This classification system organizes jobs into groups based on tasks and duties undertaken in the job. Each person listing a job title was categorized into one of the following occupational groupings: (1) Legislators, senior officials, and managers, (2) Professionals, (3) Technicians and Associate Professionals, (4) Clerks, (5) Service Workers and market sales workers, (6) Agricultural and Fishery Workers, (7) Craft and Trade related workers, (8) Plant and Machine Operators and Assemblers, and (9) Elementary Occupations. The ISCO groupings were reverse scored so that a higher number indicates a higher job classification.

Subjective Social Status. Participants were shown a drawing of a 10 rung ladder and asked to place an 'X' on the rung that best described where they stood on the ladder with respect to others in society (Adler, Epel, Castellazo & Ickovics, 2000). Previous research has shown that this scale has demonstrated adequate test retest reliability (Operario, Adler, & Williams, 2004), and it has been moderately correlated to traditional measures of SES, including education, income and occupation (Singh-Manoux, Adler, & Marmot, 2003), and predicted self-rated health and psychological well-being (Adler et al.; Hu, Adler, Goldman, Weinstein & Seeman, 2005; Singh-Manoux et al.). Further, subjective social status appears to capture aspects of SES beyond traditional, objective indicators of SES (Ghaed & Gallo, 2007). A higher score on the scale indicates higher perceived social status.

Exercise behavior. Self report, moderate intensity leisure time exercise behavior

was assessed with the Leisure Time Exercise Questionnaire (LTEQ; Godin & Shepard, 1985). The LTEQ was modified so that average duration was also provided (Vallance, Courneya, Plotnikoff, Yasui & Mackey, 2007). Participants were instructed to consider how many times per week over the past one month they engaged in moderate exercise behavior and how many minutes they typically exercised for. These two values were then multiplied to come up with an overall score in minutes. Previous research has found that the LTEQ compares favorably to other self-report measures of physical activity on a variety of criteria including test-retest reliability, objective activity monitoring and fitness (Jacobs, Ainsworth, Hartman & Leon, 1993).

Exercise intentions. Intentions to exercise were assessed with 3 items (e.g., "I intend to exercise for 30 minutes at a moderate effort level regularly during the next month") on a 7 point scale ranging from (1) strongly disagree to (7) strongly agree. Similar items have been used in previous research, and reported acceptable levels of internal consistency (Conner, Rodgers & Murray, 2007). The mean of the three items was used to represent an overall intention score, with a higher score indicating stronger intentions for exercise. Cronbach's alpha (Cronbach, 1951) for this scale was .89 indicating acceptable internal consistency (Nunnally & Bernstein, 1994).

Mastery. Mastery beliefs were measured with twelve items (Lachman and Weaver, 1998; Pearlin & Schooler, 1978) on a 7-point Likert type scales ranging from (1) strongly disagree to (7) strongly agree. Four items were used to represent perceived mastery (e.g., "I can do just about anything that I really set my mind to") and 8 items were used to represent personal constraints (e.g., "There are many things that interfere with what I want to do"). A higher score on the perceived mastery subscale indicates

stronger mastery beliefs (i.e., higher perceived control), while a higher score on the personal constraints scale indicates a stronger belief that there are factors beyond personal control preventing people from reaching life goals (i.e., lower perceived control). The scale has been used in a variety of populations, including random samples of American's (Marmot et al., 1998) and Canadian's (Bailis et al., 2001), and across varying SES strata (Bailis et al.; Lachman & Weaver, Marmot et al.). Previous research has confirmed the two factor structure of this scale (Lachman & Weaver), and found the scale to be reliable (Bailis et al.; Lachman & Weaver, 1998a, 1998b; Marmot et al.).

Perceived behavioral control. Behavioral control for exercise was measured with 7 items on a 7 point rating scale. Four of the items (e.g., "how confident are you that you can exercise regularly?") represent more typical PBC items (Armitage, 2005). The remaining three items (e.g., "I believe I have the resources required to exercise") were used to measure beliefs around resources and opportunities (Ajzen & Driver, 1992; Motl et al., 2000). The mean of the items was used to derive an overall PBC score, with a higher score indicating stronger behavioral control beliefs.

Self-efficacy for exercise. Exercise self-efficacy was assessed with 9 items (Rodgers et al., in press-b; Rodgers & Sullivan, 2001) using a 100% confidence scale ranging from 0% (no confidence) to 100% (complete confidence) according to the recommendations of Bandura (1986). Following the stem "How confident are you that you can", three items were used to represent task (e.g., "complete the exercise using proper technique") coping (e.g., "exercise when you lack energy"), and scheduling self-efficacy (e.g., "arrange your schedule to include regular exercise"). The mean of the three items representing task, coping and scheduling self-efficacy has been used in previous

research to obtain overall task, coping and scheduling self-efficacy scores (Rodgers et al.; Rodgers & Sullivan). This scale has demonstrated adequate convergent and discriminant validity (Rodgers et al.,), and acceptable internal consistency (Rodgers et al; Rodgers & Sullivan).

Procedure

A mail out survey was conducted in the city of Edmonton using the forward sortation area (FSA) and letter carrier walk (LCW) maps provided by Canada Post. The FSA provides the first three digits of a postal code and designates the general area where the mail is delivered. Each FSA contains LCW's which include the numbers of apartments, houses, farms and business for the given area. The FSA and LCW maps were matched to standard neighborhood maps and mean household income (by neighborhood) data provided by the City of Edmonton, making it possible to estimate the average income for people living within the FSA and associated LCW. As FSA's and LCW's can cover multiple neighborhoods, LCW's were selected that were exclusive to a particular neighborhood. That is, a LCW was not selected if the route covered multiple neighborhoods, as two adjacent neighborhoods sharing a LCW may have different income levels. For example, Queen Alexandra has a neighborhood mean household income of $38 285 while an adjacent neighborhood, McKernan, has a mean neighborhood household income of $58 525 (City of Edmonton, 2001).

Specifically, LCW's within the following FSA's were used: T5P, T5E, T6H, T6C. These LCW's are within eight different neighborhoods (Allendale, Canora, Cloverdale, Evansdale, Grandview Heights, High Park, Lauderdale, and Ramsay Heights) in the City of Edmonton. For the purposes of this study, LCW's which contained businesses, farms,

or primarily apartments were excluded, so that LCW's that contained houses and/or combinations of houses and apartments were selected. In order to help ensure that there was adequate representation from people with lower SES, lower income areas were over sampled. Specifically, 447 surveys were sent to households in Canora (mean household income = $33 501), 473 surveys were sent to households in Lauderdale (mean household income = $43, 900), 214 surveys were sent to households in Allendale (mean household income = $46, 476), 193 surveys were sent to households in Evansdale (mean household income = $49, 639), 178 surveys were sent to households in High Park (mean household income = $54, 109), 100 surveys were sent to households in Cloverdale (mean household income = $85, 933), 193 surveys were sent to households in Ramsay Heights (mean household income = $89, 130) and 202 surveys were sent to households in Grandview Heights (mean household income = $134, 233). Therefore, a total of 2000 surveys were sent, with approximately 17.5% of households responding to the survey (see Figure 2-1).

The survey packages, addressed to "Household Resident" were sent to the selected LCW's in the neighborhoods. The survey package included a cover letter (see Appendix 2-A), a questionnaire (see Appendix 2-B), and a postage paid business reply envelope. Only one individual, over the age of 18, in the household was asked to respond to the survey. Approximately two weeks after the survey package was mailed, a post card reminder (see Appendix 2-C) was sent to each household in the LCW. The post cards reminded participants to complete the survey, thanked participants who may have already completed the survey, and provided researcher contact information so that participants could contact the researcher to answer any questions and send a replacement survey if necessary.

The survey method included features shown to increase response rates including a post card reminder, providing postage paid business reply envelopes, use of official stationary (university), signing (information) letters by hand, making the questionnaire as easy to read as possible, and assurances of confidentiality (Dillman, 1991; Edwards et al., 2002; 2006; Ransdell, 1996). As there was no participant registry available to identify eligible participants, it was not possible to personalize the questionnaire package (by including the individual's name).

Analyses

All analyses were conducted with the Statistical Package for the Social Sciences (SPSS) version 15. The analyses proceeded in 2 stages. First, exploratory factor analysis was used with the items of all perceived control scales (i.e., perceived mastery, self-efficacy and PBC) in order to determine the composition and relationships among the control constructs. Specifically, a principal axes analysis with oblique (promax) rotation was conducted (Thompson, 2004). The number of factors to retain was determined by joint consideration of Cattell's (1966) scree plot, which involves an examination of the eigenvalue plots for breaks or discontinuities and by the Kaiser-Guttman rule (Eigenvalues <1.0). Thurstone's principle of simple structure (pattern coefficient of .30 or greater) were used as criteria to help interpret the factor solutions (Thompson). Estimates of internal consistency (Cronbach, 1951) were calculated for the constructs comprising the items retained from the EFA.

The second stage of the analysis used the factors (control constructs) for which there was evidence of psychometric validity (i.e., the results from the EFA). Descriptive statistics and zero order correlations were calculated for all study variables. Mediation

analysis was conducted to examine if the effect of SES on behavior is mediated through control beliefs. Because this study included multiple mediators (i.e., mastery, constraints, task self-efficacy, coping self-efficacy and PBC), a multiple mediation analysis was performed (Preacher & Hayes, 2007). This analysis is an extension of regression and was used to examine simultaneous mediation by multiple variables, and was performed separately for each of the independent variables, in this case, each indicator of SES.

The analysis produces traditional *direct effects* (i.e., paths *a*, *b*, c and c', see Figure 1), as well as *indirect effects* (i.e., total indirect effect of the mediators and specific indirect effect of each mediator, or *ab* paths). The direct effects coefficients reported are standardized regression coefficients (beta). Bootstrapping was used to examine the specific total and indirect effects (*ab* paths) of the mediators (Preacher & Hayes, 2007) using point estimates and 95% percentile and bias corrected confidence intervals (CI; Preacher & Hayes). The *total indirect effect* represents the ability of the set the variables (proposed mediators) as a whole to mediate the effects of X on Y. The *specific indirect effect* represents the ability of that specific variable to mediate the effect of X on Y controlling for all other mediators, thus it represents a given variable's unique ability to mediate the effect of X on Y (Preacher & Hayes). Although Preacher and Hayes state that investigating multiple mediation needs to only include examination of the total indirect effect and specific indirect effects associated with each mediator, the direct effects are also presented for the following paths: IV to each of the mediators (path a), mediators to the DV (path b), and IV to DV (path c') as well as the total effect of IV on the DV (path c).

The multiple mediation presented differs slightly from the causal steps model (see Figure 2-2; Baron & Kenney, 1986 for illustration of causal steps model), in that there is no requirement that the total effect of the IV on the DV (i.e., path c, see Figure 2-3) be statistically significant prior to analysis when examining multiple mediators (see also Kenney, Kashy & Bolger, 1998; MacKinnon, 2008; Preacher & Hayes, 2007; Shrout & Bolger, 2002). Figure 2-3 provides an illustration of the multiple mediation model proposed by Preacher and Hayes. Additionally, according to Preacher and Hayes, when interpreting the multiple mediation analysis, focus should not be placed on the significance of paths *a* and *b*, as is done in the casual steps approach. Rather, the focus in interpretation is on direction and size of indirect effects (i.e., the *ab* paths). This results in fewer inferential tests, enhancing power and reducing the probability of Type I error (Preacher & Hayes). Further, while longitudinal data are generally preferable to cross sectional data when conducting mediation analysis, it is acceptable to perform mediation analysis with cross sectional data (MacKinnon, 2008). With cross sectional data, the ordering of the variables in mediation analysis is generally based on theoretical grounds and/or prior research (MacKinnon).

Results

Data screening and Preparation

Data were first screened for both missing and unusual values (those values outside the possible response options) by examining the means, ranges and frequencies of responses to each item (Tabachnik & Fidell, 2001). Missing and unusual values were checked with original data and replaced with the appropriate value or confirmed as missing.

For SES indicators, there was relatively little missing data. For level of education, there were data missing from 2 participants (.6%). Subjective social status was missing from 1.1% of

the participants ($n = 4$). Annual household income was missing from 5.1% ($n = 18$) of the participants. Occupational title was missing from 10 participants (2.84%). An additional 12

participants could not be classified into occupational categories due to inadequate or poor job descriptors. Because there was little missing data overall (Tabachnik & Fidell, 2001) for education, subjective social status and income, the missing values were replaced with the mean level of the item for their given neighborhood as reported by other participants in the study. This likely resulted in a more conservative estimate of SES indicators, as people with higher SES are more likely to participate in research (Abraham, Maitland, & Bianchi, 2006; Lorant, Demarest, Mierman & Van Oyen, 2007). As there was a larger percentage of data missing for occupation status, individuals missing occupation data were excluded from the regression analyses.

Some participants did not respond to all of the items for BI, PBC, self-efficacy and perceived mastery scales. The rate of the missing data ranged from 1 – 17 (.3% - 4.8%) missing values per item. For example, there was 1 response missing for mastery item 1, and 17 responses were missing from self-efficacy item 4. Because the number of missing values was low, missing data for each item was replaced with the mean of the participant's response for the other items that comprised the appropriate subscale where possible (Tabachnik & Fidell, 2001). Some participants did not respond to any items for a particular scale, and as such mean responses could not be calculated, and these

participants were excluded from analyses. Specifically, for PBC and behavioral intentions, there were 5 participants who did not respond to any items. For self-efficacy, there were 8 participants who did not respond to the scale.

Data were also screened for outliers. Outliers are extreme values or data points (Tabachnik & Fidell, 2001; Osborne & Overbay, 2004), which fall far outside the norm for a variable or population, for example a data point that is three or more standard deviations from the mean (Osborne & Overbay). Outliers were initially examined using z-scores, histograms, and box plots (Osborne & Overbay; Tabachnik & Fiddel). Potential outliers were examined with the raw data to determine possible data entry errors, which were subsequently corrected. The skewness and kurtosis of the exercise data was also examined (see Table 2-2). As this was a larger sample (i.e., greater than 100 cases), the impact of the distribution (i.e., skewness and kurtosis) in the analysis is minimized (Tabachnik & Fidell, 2008). Further, follow up regression analysis was used to examine impact of remaining outliers. Specifically, Cook's D and the leverage values were examined. Results suggested that the impact of the potential outliers was minimal as all Cook's D values were below 1 and the leverage values were low (Kleinbaum, Kupper & Muller, 1988). Therefore, the distribution of certain variables (e.g., exercise) did not appear to be impacting the data analysis, and subsequently none of the data were transformed.

Descriptive Statistics

A higher percentage of surveys were returned from higher income neighborhoods than lower income neighborhoods. Specifically, 31 surveys (7%) were returned from Canora, 67 (14%) surveys were returned from Lauderdale, 46 surveys (21%) were

returned from Allendale, 28 surveys (15%) were returned from Evansdale, 50 (28%) surveys were returned from High Park, 22 (22%) surveys were returned from Cloverdale, 56 surveys (29%) were returned from Ramsay Heights, and 50 surveys (25%) were returned from Grandview Heights. One survey had its neighborhood indicator spoiled by the participant, and as such the neighborhood the survey was returned from is unknown.

As seen in Table 2-1, about two thirds of the participants were women (65.4%). Just under half of all participants reported being employed full time, with approximately 27% of the sample reporting that they were not currently active in the workforce (i.e., homemakers, unemployed or retired). About 27% of the sample reported having a high school diploma or less, 20% reported taking some college/university and just over half reported having a college or university degree. In terms of occupation, approximately half of the sample was classified as a technician and associate professional or higher. For income, about 11% reported having a household income of less than $30 000 a year, approximately 28% reported making between $30 000 and $60 000 a year, and about 60% report making $60 000 a year or greater, with 32% of total sample reporting an annual family income of greater than $100 000/year. Respondents were overall quite educated and had a relatively high occupational ranking. The average household income (adjusted for family size) was approximately $50 000 per year. Participants reported modest levels of subjective social status (see Table 2-2).

Overall, in terms of the perceived control variables, participants reported relatively high mastery beliefs, perceiving that they had personal control over life events, and had low personal constraints (see Table 2-2). That is, participants responded that there were few obstacles in their way that prevented them from reaching life goals.

Participants were quite confident in their ability to perform exercise (i.e., task self-efficacy), but were only marginally confident in their ability to cope with regular exercise (i.e., scheduling and coping self-efficacy). Participants reported high levels of perceived behavioral control, indicating that they believed that exercise was within their personal control, and that they had the resources and opportunities to be active, and had strong intentions to exercise over the next month.

Just over 20% of participants (n = 74) indicated that they had a physical condition which limited their participation in exercise. However of those people, a large proportion (70%) still reported engaging in moderate intensity exercise. Further, some participants indicated (by writing on the survey) their physical limitation, and responses included physical health factors such as high blood pressure, being overweight, or having type II diabetes. Further, factors such as "lack of time" were also identified. These reasons should not limit one's *physical* ability to be active. Because this question did not seem to accurately represent people who have a physical impairment preventing them from exercising, it was not used in the analyses.

Distinction Between Mastery, Self-efficacy and PBC - Exploratory Factor Analysis

A principal axes analysis with oblique (promax) rotation was performed on the 28 items from the mastery, exercise self-efficacy and PBC scales. An examination of the eigenvalues

suggested the retention of a 6 factor solution, given that the first 6 eigenvalues extracted were greater than 1.0 ($\lambda_1 = 10.42$; $\lambda_2 = 2.93$; $\lambda_3 = 1.85$; $\lambda_4 = 1.67$; $\lambda_5 = 1.19$; $\lambda_6 = 1.04$; $\lambda_{7\text{-}28}$ ranged from .86 - .12). Additionally, the scree plot indicated that the biggest change in slope came after 4 or 5 factors. Six factors were extracted and transformed using promax

rotation. Based on the majority of the items for each factor, the six factors initially extracted could be described as: PBC (factor 1), coping self-efficacy (factor 2), personal constraints (factor 3), task self-efficacy (factor 4), and perceived mastery (factor 5). The three items loading on factor 6 were made up from items from multiple scales, and all items on factor 6 shared loadings on other factors (i.e., lacked simple structure), indicating that the 6 factor solution may not be appropriate. Specifically, PBC item 1 ("how much I exercise is completely up to me") and mastery items 2 ("what happens to me in the future mostly depends on me") and 12 ("there is really no way to solve some of the problems that I have") all cross loaded on factor 6. PBC item 7 ("I am capable of exercising") and self-efficacy item 4 ("exercise when I feel discomfort from the activity") cross loaded on factor 4.

Following the first iteration, PBC item 1 was removed as it lacked evidence of simple structure. After the removal of PBC item 1, five factors were extracted transformed using promax rotation over two iterations. Two items shared loadings on other factors, specifically self-efficacy item 4 and PBC item 7 were both cross loading with factor 4 and these items were sequentially removed from analyses. Results of the principal axes analysis suggested the retention of 5 factors, accounting for 57.9% of the variance. All items had a meaningful (i.e., greater than .30) pattern coefficient on only one factor.

Examination of the pattern matrix (Table 2-3) shows the factor structure of the control items. Of the 5 items that loaded on Factor 1, three were originally intended to assess scheduling self-efficacy and two were originally intended to assess coping self-efficacy. Scheduling self-efficacy is considered a sub-type of coping self-efficacy

(Rodgers & Sullivan, 2001), and all items relate to confidence to exercise under a variety of conditions (e.g., when busy or not feeling well). As a result, this factor was named "coping self-efficacy." The eight items in Factor 2 were all originally intended to assess personal constraints (from the perceived mastery scale), and as such was labeled "personal constraints". The five items in Factor 3 were originally intended to assess PBC, and this factor was subsequently labeled "PBC". The three items in Factor 4 were originally intended to assess task self-efficacy, and this factor was labeled "task self-efficacy". The four items in Factor 5 were originally intended to assess perceived mastery, and was therefore labeled "perceived mastery". All factors had acceptable levels of internal consistency (see Table 2-3; Nunnally & Bernstein, 1994).

Relationship of Control Beliefs to Exercise Intentions and Behavior

The independent contributions of mastery, self-efficacy and PBC to the prediction of intentions of engage in moderate exercise behavior over the next 4 weeks and to moderate exercise behavior was examined using simultaneous hierarchical regression analyses.

Descriptive statistics and correlations among study variables are reported in Table 2-2 and Table 2-4 respectively. As expected, the control variables were all moderate to strongly correlated (Cohen, 1988), with task and coping self-efficacy being most strongly correlated (r = .68) and constraints and task self-efficacy sharing the weakest correlation (r = -.34). All control variables were significantly positively related to exercise intentions and behavior, with the exception of constraints which was significantly negatively related to both intentions and behavior (participants who reported higher barriers or obstacles in their lives were less likely to report intending to engage in moderate effort exercise and

reported engaging in less exercise). Coping self-efficacy had the strongest correlation to exercise intentions (r =.68) and to behavior (r = .53).

The control variables were also examined for evidence of multicollinearity. Multicollinearity refers to moderate to high intercorrelations between independent or predictor variables (Stevens, 2002). It can be of concern in regression analysis as it may limit the size of R, making it difficult to determine the relative importance of a given predictor variable, and it can increase the variances of the regression coefficients which may cause unstable regression equations (Stevens). As the control variables shared moderate to high correlations, collinearity diagnostics were examined. Specifically, the variance inflation factor (VIF) was examined (Stevens), as well as the condition index and variance proportions (Tabachnick & Fidell, 2007). A VIF value of greater than 10 (Stevens), and a condition index greater than 30 together with variance proportions greater than .50 on at least two variables (Tabachnick & Fidell) all indicate problems with multicollinearity. These criteria were not met in any of the regression analyses, suggesting that multicollinearity among control variables was likely not a serious concern.

The independent influence of control variables (mastery, self-efficacy and PBC) on exercise behavior and intentions were examined using separate simultaneous hierarchical regression analyses (see Table 2-5 and Table 2-6 respectively). Since one of the purposes of this study was to examine the potential contribution of each control construct, each of the control constructs (mastery, self-efficacy and PBC) were entered (in subsets) separately at first, then in pairs, and then all three were entered together. For intentions, behavior was entered first with each of the control constructs, as previous

research has shown past behavior to be a predictor of intentions (Armitage, 2005; Godin, Valois, Jobin & Ross, 1991). The variables were entered into the regression analysis based on their domain specificity, as this was the primary way in which the kinds of control were differentiated from each other. That is, the generalized control beliefs were entered first (as conceptually they are considered the most distal to intentions and behavior), followed by the behavioral specific variables, self-efficacy and PBC.

Mastery and constraints were entered into the regression equation on the first subset ($F = 18.64$ (2, 348), $p < .001$), accounting for approximately 10% of the variance in exercise behavior, with personal constraints being the only significant predictor variable. Task and coping self-efficacy were entered on subset 2, accounting for a total of 28% of the variance in behavior, with only coping self-efficacy making a significant contribution. PBC was entered on subset 3, and accounted for 10% of the variance in behavior. Thus, the subset containing self-efficacy resulted in the most explained variance in behavior.

On subset 4, mastery, constraints, task and coping self-efficacy were entered into the regression equation, accounting for 29% of the variance in behavior. The addition of the self-efficacy variables (subset 1 to subset 4) was significant, with personal constraints and coping self-efficacy being the only significant predictors. On subset 5 mastery, constraints and PBC were entered, accounting for 13% of the variance in behavior. The addition of PBC (subset 1 to subset 5) was significant, with personal constraints and PBC being the only significant variables. On subset 6 task self efficacy, coping self-efficacy and PBC were entered, explaining 28% of the variance in behavior. The addition of PBC (subset 2 to subset 6) was not significant, and coping self-efficacy was the only

significant predictor. Finally, on subset 7 mastery, constraints, task self-efficacy, coping self-efficacy and PBC were all entered into the regression equation, and together explained 29% of the variance in behavior. Personal constraints and coping self-efficacy were the only significant predictors. The addition of PBC after the self-efficacy variables (subset 4 to subset 7) was not significant (see Table 2-6).

For the prediction of intentions, behavior was entered first, and it accounted for approximately 22% of the variance in intentions. On subset 2 mastery and constraints were added into the regression equation after behavior, with all variables accounting for a total of 27% of the variance in intentions. All three variables were significant predictors, although behavior had the largest beta coefficient, followed by mastery. Task and coping self-efficacy were entered into the regression equation after behavior subset 3. Behavior and coping self-efficacy were the significant predictors, explaining a total of 48% of the variance. PBC was entered after behavior on subset 4, and both variables made a significant contribution to the regression equation, accounting for a total of 40% of the variance. Therefore, the subset containing behavior and the self-efficacy variables resulted in the most explained variance.

On subset 5, behavior, mastery and constraints were entered followed by task and coping self-efficacy, with all variables explaining a total of 48% of the variance in intentions. With the addition of self-efficacy beliefs (subset 2 to subset 5), mastery and constraints were no longer significant predictor variables. Past behavior and coping self-efficacy were the only significant predictor variables. On subset 6, PBC was added after behavior, mastery and constraints. With the addition of PBC, mastery and constraints were no longer significant predictor variables (subset 2 to subset 6). Past behavior and

PBC were the only significant predictors, explaining a total of 40% of the variance. Subset 7 included past behavior, self-efficacy beliefs and PBC. The addition of PBC following efficacy beliefs (subset 3 to subset 7) was significant, explaining a total of 52% of the variance in intentions. Past behavior, coping self-efficacy and PBC were all significant predictor variables. Finally, subset 8 included past behavior and control variables together, explaining a total of 51% of the variance in intentions. Past behavior, coping self-efficacy and PBC were significant predictor variables.

Relationship Between Control Beliefs, Socioeconomic Status, Exercise Intentions and Behavior

Descriptive statistics and correlations for all study variables are in Table 2-2 and Table 2-4. There were significant positive associations, with medium to large correlation coefficients (Cohen, 1988), between all of the indicators of socioeconomic status (r's = .24 - .50). The highest correlation coefficient was shared between income and social status, and education and occupation. The smallest correlation was between social status and occupation. Income, education and social status were positively associated with intentions to exercise, and income and social status were the only indicators of SES that were positively associated with exercise behavior. The correlation coefficient between SES and exercise intentions and behavior were small to medium in magnitude (Cohen).

There were also significant associations between the indicators of SES and control variables, with small to medium correlation coefficients (Cohen, 1988). However, contrary to the hypotheses, the behavioral specific control variables were related to SES in a similar magnitude as the generalized control beliefs, with the highest correlation coefficient being between PBC and subjective social status, and the lowest

correlation coefficient between mastery and income. Personal constraints, task self-efficacy and PBC were all significantly associated with each indicator of SES. Personal constraints was negatively related to income, education, occupation and subjective social status while both task self-efficacy and PBC were positively associated with each indicator of SES. Coping self-efficacy was positively associated with income, education and social status, but was not significantly related to occupation. Perceived mastery was positively associated (albeit weakly) with only income and social status. Income and social status were the only two indicators of SES that were significantly related to all perceived control constructs.

Hierarchical linear regression analyses were conducted examining the effects of SES (income, education, occupation and social status) and control beliefs (perceived mastery, personal constraints, task self-efficacy, coping self-efficacy and PBC) on behavior (see Table 2-7) and exercise intentions (see Table 2-8). For the analyses, indicators of SES were entered on step 1, mastery beliefs were entered on step 2, self-efficacy beliefs on step 3 and PBC was entered on step 4.

Results of the regression predicting behavior (Table 2-7) showed that the indicators of SES made a significant contribution to the regression equation, with income having a significant beta coefficient. Once mastery beliefs were entered on the second step, the effect of income on behavior was still significant (although attenuated), and personal constraints was also significant. With the addition of self-efficacy beliefs on step 3, coping self-efficacy emerged as a significant predictor. PBC did not make a significant contribution to the regression model. The effect of income of behavior was no longer significant after the self-efficacy variables were entered. In the final model approximately

27% of the variance in behavior was explained, with personal constraints and coping self-efficacy being the only significant predictors.

Results of the hierarchical linear regression predicting exercise intentions (Table 2-8) showed that the indicators of SES made a significant contribution to the regression equation, with subjective social status having a significant beta coefficient. Perceived mastery and social status were both significant on the second step. Perceive mastery was no longer significant once the self-efficacy variables were entered in the regression equation. PBC did make a significant contribution to exercise intentions. In the final model, approximately 53% of the variance in intentions was explained, with subjective social status, coping self-efficacy and PBC being significant predictors.

The Effect of SES on Exercise Behavior Through Multiple Control beliefs

Results of the hierarchical linear regression suggest that control beliefs may be mediating (partially or fully) the effect of SES on behavior and intentions. In order to formally examine if control beliefs (i.e., mastery, constraints, task self-efficacy, coping self-efficacy and PBC) mediated the relationship between SES and behavior, multiple mediation analyses were conducted (Preacher & Hayes, 2007) with each given indicator of SES. That is, a separate multiple mediation analysis was performed for each given SES variable (income, education, occupation, and subjective social status). Although income emerged as the only significant SES indicator in the regression examining behavior (and socials status for intentions), the indicators of SES all share moderate correlations (as do the control beliefs). This can make determining the importance of the given (predictor) variables difficult, as the effects of the other related variables can be masked (Stevens,

2002). Therefore, mediation was examined with each SES indicators, and all on the control beliefs were included as potential mediators.

For income (F (6, 336) = 23.12, $p < .001$; $R^2 = .29$; $R^2_{adj} = .28$), education (F = 23.16 (6, 336), $p > .001$; $R^2 = .29$; $R^2_{adj} = .28$), occupation (F = 20.86 (6, 314), $p > .001$; $R^2 = .28$; $R^2_{adj} = .27$) and subjective social status (F = 23.14 (6, 336), $p > .001$; $R^2 = .29$; $R^2_{adj} = .28$), the overall direct effects models were significant (see Figures 2-4, 2-5, 2-6, and 2-7 respectively). In terms of the direct effects of SES on control beliefs (i.e., *a* paths), both income and subjective social status were significantly associated with each of the control variables. Education was significantly associated with all control beliefs except perceived mastery, and occupation was associated with personal constraints, task self-efficacy and PBC. For the direct effects of the control beliefs on behavior (i.e., *b* paths), personal constraints and coping self-efficacy were significantly associated with behavior for each indicator of SES.

The total effect for each indicator of SES on behavior (i.e., *c* path, see Figure 2-3) was significant for income ($\beta = .17$, $p < .01$) and subjective social status ($\beta = .16$, p =.003). Once the mediators were included, the direct effect of income and subjective social status on behavior (i.e., *c'* path) was reduced ($\beta = .02$, $p = .74$ and $\beta = -.02$, $p = .66$, respectively). For education, the total effect on behavior was not significant ($\beta = .08$, p =.15), although the coefficient was reduced ($\beta = -.02$, $p = .61$) after inclusion of the mediators. For occupation, the total effect ($\beta = .04$, p =.46) was not significant and after the mediators were included, the direct effect ($\beta = -.02$, p =.72) was only slightly reduced.

The indirect effects are presented in Table 2-7. The total indirect effect of income (point estimate = .15, $p < .001$; BC CI_{95} = .10 to .22), education (point estimate = .10, $p <$

.01; BC CI_{95} = .04 to .18) and subjective social status (point estimate = .18, $p < .001$; BC CI_{95} = .11 to .26) on behavior through the control beliefs was significant. This demonstrates that for income, education and social status, there was a significant difference between the total effect (i.e., *c* paths) and direct effect (i.e., *c'* paths). Thus, as a *set* the control beliefs were acting as mediators in the relation between the respective indicator of SES and behavior. Further examination of the specific indirect effects (see Table 2-7) showed that personal constraints and coping self-efficacy were the only two control variables to act as mediators in the relation between each given indicator of SES (income, education and social status) and behavior. For occupation, the total indirect effect was not significant (point estimate = .06, $p = .085$; BC CI_{95} = -.01 - .13). However, it is possible to have a significant indirect effect even if the total indirect effect is non significant (Preacher & Hayes, 2007). Examination of the specific indirect effects showed that personal constraints was a mediator in the relation between occupation and behavior.

The Effect of SES on Exercise Intentions Through Multiple Control Beliefs

In order to examine if control beliefs mediated the relationship between SES and intentions to exercise, multiple mediation analyses were conducted (Preacher & Hayes, 2007), following the same procedures as the analyses for behavior. Because previous research has shown past behavior to be a significant predictor of future behavior, participants past exercise behavior was controlled for in each model.

For income (F (7, 335) = 52.42, $p < .001$; $R^2 = .52$; $R^2_{adj} = .51$), education (F (7, 335) = 53.43, $p < .001$; $R^2 = .53$; $R^2_{adj} = .52$), occupation (F (7, 313) = 48.28, $p < .001$; $R^2 = .52$; $R^2_{adj} = .51$) and subjective social status (F (7, 335) = 55.07, $p < .001$; $R^2 = .54$; $R^2_{adj} = .53$), the overall direct effects models were significant (see Figures 2-8, 2-9, 2-10 and

2-11 respectively). In terms of the direct effects of SES on control beliefs (i.e.., *a* paths), social status was the only indicator of SES that was significantly associated with each of the control variables (see Figure 10). Both income and education were significantly associated with each of the control variables except perceived mastery. Occupation was significantly associated with personal constraints, task self-efficacy and PBC. For the direct effects of control beliefs on intentions (i.e., *b* paths), coping self-efficacy and PBC were significantly associated with exercise intentions for each indicator of SES. Further, past behavior exerted a direct influence on intentions in each model.

The total effect of each indicator of SES on intentions (i.e., *c* path) was significant for income ($\beta = .18, p < .001$), education ($\beta = .18, p < .001$) and social status ($\beta = .27, p < .001$). Once the mediators were included, the effect of income ($\beta = .07, p = .10$), education ($\beta = .10, p = .01$), and social status ($\beta = .15, p < .001$) on intentions (*c'* path) was reduced. For occupation, the total effect on intentions was not significant ($\beta = .07, p = .11$), and with the mediators included, the direct effect of occupation on intentions (*c'* path) was reduced slightly ($\beta = .04, p = .34$).

The indirect effects are presented in Table 2-8. The total indirect effect of income (point estimate = .11, $p < .001$; BC CI_{95} = .05 to .17), education (point estimate = .08, $p < .01$; BC CI_{95} = .02 to .14), and subjective social status (point estimate = .13, $p < .001$; BC CI_{95} = .06 to .21) on intentions through the five control beliefs was significant. Thus, there was a significant difference between the total effect (i.e., *c* paths) and direct effect (i.e., *c'* paths) and together the control beliefs were acting as mediators in the relation between the respective indicator of SES and intentions. Further examination of the specific indirect effects (see Table 2-8) showed that coping self-efficacy and PBC were

the only two control beliefs that acted as mediators between the given indicator of SES and intentions. The total indirect effect of occupation on intentions through the five mediators was not significant (point estimate = .04, p = .242; BC CI_{95} = -.03 to .11), showing that there was no difference between the total effect (i.e., c path) and direct effect (i.e., c' path). Further examination of the specific indirect effects showed that no control variables acted as mediators in the relation between occupation and exercise intentions.

Discussion

There were two main objectives of the current study. The first main objective was to examine whether mastery, self-efficacy and PBC were psychometrically distinct constructs. The second main objective was to examine the associations among the control beliefs, SES and exercise behavior. Specifically, this study examined whether control beliefs mediated the association between SES and behavior.

Evidence for Different Constructs

Results from the EFA supported the hypothesis that mastery, self-efficacy and PBC would form separate latent variables. That is, mastery beliefs formed two separate constructs, perceived mastery and personal constraints. Self-efficacy formed two constructs, task self-efficacy and coping self-efficacy. Behavioral control over exercise formed a single construct, PBC. These findings support previous research showing that self-efficacy and PBC can be conceptually and statistically distinguished from each other (Armitage & Conner, 2001; Dzewaltowski et al., 1990; Hagger et al., 2002; Povey et al.; Rodgers et al., in press-a; Terry & O'Leary, 1995; Trafimow et al., 2002). Results were

consistent with previous research showing that perceived mastery and personal constraints are separable constructs (Lachman & Weaver, 1998).

Inconsistent with past research (cf. Rodgers et al., in press-b) was the finding that coping and scheduling self-efficacy did not form two distinct constructs. That is, Rodgers and colleagues (Rodgers et al., in press-b; 2002a; 2002b; Rodgers & Sullivan, 2001) found that task, coping and scheduling self-efficacy each form separate latent constructs. Scheduling self-efficacy is considered a subtype of coping self-efficacy and the two are correlated (Rodgers & Sullivan). It may be the case that for certain populations, coping and scheduling self-efficacy are not separable constructs. Both coping and scheduling self-efficacy refer to barriers surrounding exercise, and perhaps the barrier of scheduling cannot be differentiated from the other barriers surrounding exercise (e.g., exercising when not feeling well or when feeling tired). That is, some people may view these two types of barriers as one overall barrier. This might be especially true for people who have less experience with exercise. For this study, participants were, on average, active in moderate activity for about 160 minutes a week. However, there was considerable variation around exercise level, and people with lower exercise levels in particular may have found it more difficult to differentiate between scheduling and coping self-efficacy. Further research examining whether or not exercise self-efficacy construct distinction is related to population characteristics is warranted to address this issue.

Results from the regression analyses offer further evidence that mastery, self-efficacy and PBC are separable constructs as they differently related to exercise intentions and behavior. For behavior, each of the control beliefs subsets (i.e., subset 1 contained only mastery and constraints; subset 2 contained only task and coping self-

efficacy; subset 3 contained only PBC) was able to account for a significant amount of the variance in behavior. The addition of either self-efficacy or PBC after perceived mastery and personal constraints significantly increased the variance accounted for in moderate effort exercise behavior. However, personal constraints remained a significant statistical predictor of behavior after the behavioral specific beliefs (i.e., self-efficacy and PBC) were included. This suggests that for exercise behavior, personal constraints are not redundant to self-efficacy or PBC. Further, although coping self-efficacy had the strongest association with behavior, generalized control beliefs also made a significant contribution, demonstrating that generalized control beliefs may play an important role in specific health behaviors (cf. Bandura, 1997; Haidt & Rodin, 1999). Perceiving control over one's life appears to be an important correlate of exercise behavior, but the amount of variance explained in behavior increased significantly with the inclusion of behavioral specific control beliefs, particularly self-efficacy.

Although both self-efficacy and PBC increased explained variance in behavior after the inclusion of mastery beliefs, PBC did not account for additional variance in behavior when it was included in the model with the self-efficacy beliefs. This suggests that PBC was redundant to self-efficacy for moderate effort exercise behavior, because it did not retain a significant influence on behavior when self-efficacy was included in the same equation. Both self-efficacy and PBC reflect an individual's control over exercise, specifically both reflect an individual's confidence that they can exercise (although PBC to a lesser extent), so it is possible that they may be redundant. However, they also differ in that PBC theoretically also reflects an individual's resources and opportunities for exercise. Perhaps they are not redundant, but self-efficacy was simply a stronger correlate

of behavior than PBC. There is some support for this from correlation coefficients, which shows that coping self-efficacy was more strongly related to behavior than was PBC. Other studies have similarly found that self-efficacy was a better statistical predictor of behavior than PBC (Dzewaltowski et al., 1990; Rodgers et al., in press-a; Povey et al., 2000).

For intentions, each of the control beliefs subsets separately explained a significant amount of variance, even after the inclusion of past/current behavior. Again, the subset containing self-efficacy beliefs was able to account for the most variance in intentions, followed closely by PBC, and then mastery beliefs. With the inclusion of the behavior specific beliefs (both in the case of self-efficacy and PBC) after perceived mastery and personal constraints, the effect of mastery and constraints on intentions was attenuated. That is, mastery and constraints were no longer significant statistical predictors of intentions when either self-efficacy or PBC were included in the model. This may suggest that for exercise intentions, generalized control beliefs were redundant to behavioral specific beliefs. Another explanation may be that the influence of generalized beliefs on intentions was mediated through the behavioral specific beliefs. Lachman and Weaver (1998a) have previously argued that generalized control beliefs represent a composite of control beliefs over different areas of life. If this is the case, it may be that generalized beliefs influence domain or behavioral specific control beliefs, which in turn may influence intentions to engage in certain health behavior such as exercise. Future research would need to test these ideas.

For exercise intentions, both coping self-efficacy and PBC, when included in the same regression model, remained significant statistical predictors. Although coping self-

efficacy had the strongest association to intentions to exercise, both constructs made a unique contribution to exercise intentions. The influence of PBC on intentions was somewhat attenuated by the inclusion of the self-efficacy beliefs, which may suggest that PBC and self-efficacy share similar features (Hagger et al., 2002). Overall, these findings are similar to the results of a meta analytic review presented by Hagger et al., that showed that both self-efficacy and PBC were important predictors of intentions to be active.

Based on the results of the EFA and regression analyses, it appears that overall, the various kinds of control can be differentiated from each other, and show different associations to intentions and behavior. Coping self-efficacy emerged as the key control belief for both exercise intentions and exercise behavior. However, for exercise behavior, personal constraints, a generalized control belief, was also an important variable. The formation of positive intentions, however, appears to be more strongly associated with the behavioral specific control beliefs than the generalized beliefs. Both coping self-efficacy and PBC were key correlates of intentions to engage in moderate effort exercise. An interesting question for future research may be to determine if generalized control beliefs influence domain or behavioral specific control beliefs. Perhaps there is a hierarchical relationship between the different kinds of control. While this study found that generalized control had a direct influence on behavior, it did not have a direct influence on intentions.

Associations among SES, Perceived Control and Exercise Intentions and Behavior

It was hypothesized that the more distal beliefs (i.e., SES and mastery beliefs) would be more strongly related to each other than to the proximal beliefs (self-efficacy and PBC), and that the proximal beliefs would be more strongly related to each other than

to the distal beliefs (self-efficacy, PBC, intentions and behavior). That is, the variables would show a simplex pattern of relationships to each other. In terms of the associations among the control beliefs, there was some evidence of a simplex pattern of relations. The two self-efficacy variables and PBC were most strongly correlated with each other, and the magnitude of the associations between task and coping self-efficacy and between self-efficacy and PBC fell within previously reported ranges (Rodgers et al., in press-b; Rodgers & Sullivan, 2001; Povey et al., 2000; Terry & O'Leary, 1995). However, among the distal control beliefs there was no such pattern of relations. Although the correlation between perceived mastery and personal constraints was similar to what has been found in previous research (Lachman & Weaver, 1998a), perceived mastery was most strongly associated with task self-efficacy (not personal constraints), and personal constraints was most strongly correlated with PBC.

One way in which the distal, generalized control beliefs differ from the proximal behavioral specific beliefs was in terms of domain specificity, and this was the primary way these beliefs were differentiated in this study. But there are other ways in which the control beliefs could have been differentiated, and as such other ways in which they may be similar or different from each other. For example, Lachman (2000) differentiates control beliefs in terms of 'agency' and 'control'. According to Lachman, agency beliefs reflect perceived abilities of the self to perform a given action. This would be reflected primarily in perceived mastery (the extent to which one believes he/she can influence areas of his/her life), and self-efficacy beliefs (the extent to which one believes they can perform exercise). Alternatively, Lachman states that 'control' beliefs reflect an individual's belief about the responsiveness of the environment, and deal with the degree

to which one believes that there may be circumstances outside one's control preventing them from reaching a given outcome. This would be reflected in the personal constraints construct (the extent to which people believe that there are obstacles or barriers in their lives preventing them from reaching important life goals), and to some extent it would also be reflected in PBC. PBC refers to the presence or absence of factors that may facilitate or impair behavioral performance, and includes people's expectations about the degree to which they can control their behavior (an agency belief according to Lachman) and also "the extent to which they have the requisite resources, and believe they can overcome whatever obstacles they may encounter" (Ajzen, 2002a, p. 677), which arguably could be categorized as a 'control' belief. Conceptualized this way, then higher correlations between mastery and task-self-efficacy would be expected and higher correlations between PBC and constraints would be expected. This is what was found, as the correlations showed that mastery was most strongly related to task self-efficacy and constraints was most strongly related to PBC.

In the self-efficacy and PBC literature, similar arguments have been made for the distinction between the two constructs in terms of internal and external control beliefs, where efficacy based beliefs were considered 'internal' and beliefs surrounding barriers and external constraints have been labeled 'external' control beliefs (Hagger et al., 2002; Terry & O'Leary, 1995). Thus, perhaps perceived mastery was more highly related with self-efficacy (than with personal constraints) as both reflect agency beliefs, or internal control beliefs. Similarly, personal constraints may have more strongly correlated with PBC (and not mastery) as both constructs reflect external control beliefs.

In terms of the associations among the control beliefs, intentions and behavior, the more proximal, behavioral specific control beliefs were related more strongly to intentions than were the generalized control beliefs. Specifically, coping self-efficacy was most strongly related with intentions (r =.68) and mastery and constraints had the weakest association with intentions to exercise (.29 and -.29 respectively). This is not surprising given that the behavioral specific control beliefs are targeted towards control over exercise, whereas the generalized control beliefs are targeted towards control over life in general. While the self-efficacy beliefs were the most strongly related to behavior, personal constraints and PBC were both related to behavior in a similar magnitude. Thus, as a whole, the proximal control beliefs did not necessarily share stronger associations with behavior than the generalized beliefs.

Previous research has found that generalized control beliefs were weakly associated with exercise behavior (Bails et al., 2001). However, Bailis et al. used a composite measure of mastery beliefs (i.e., they did not differentiate between perceived mastery and personal constraints) and also used a measure of overall leisure time activity. In this study, personal mastery and perceived constraints were assessed, and only moderate effort exercise was examined. Perhaps for exercise behavior, the notion that there may be barriers in your life in general (i.e., personal constraints) is the key distal control belief. Additionally, it is possible that generalized control beliefs show a stronger relation to more structured, specific types of exercise, like moderate effort exercise than more general activity measures. For example, there may be more perceived barriers to engaging in moderate effort exercise like jogging or weight lifting than activities such as gardening or easy walking, which may require fewer resources.

There was no simplex pattern of relationship found among SES and the control beliefs. Both the distal and proximal control beliefs were related to SES in a comparable magnitude. For example, personal constraints, task self-efficacy and PBC were all moderately correlated with the various indicators of SES. The distal, generalized control beliefs were not more strongly related to SES than the proximal, behavioral specific beliefs. Although the exact pattern of relationships among the control beliefs and SES was not what was hypothesized, perceived control was positively associated with SES, consistent with the hypotheses. Respondents with greater income, more education, better jobs and higher social status reported fewer barriers in their lives, greater confidence in their ability to exercise and greater control over exercise. Respondents' confidence in their ability to cope with exercise was positively related to each indictor of SES, except for occupational status, and mastery beliefs were positively related to two indicators of SES, income and social status.

These findings are consistent with previous research showing people with higher SES report greater levels of control over their life and are less likely to believe in the existence of external constraints (Bailis et al., 2001; Cohen et al., 1999; Kubzansky et al., 1998; Lachman & Weaver, 1998a), and have higher self-efficacy for exercise (Clark, 1995; Clark et al., 1995; Clark & Nothwehr, 1999; Gecas, 1989). These findings also extend previous research examining control beliefs and SES by including PBC, and demonstrate that PBC shows a similar positive association to SES as mastery and self-efficacy. People with higher SES may have more resources and greater opportunities in their lives and this may engender a greater sense of control in individuals. For example, people with higher income likely have more economic resources and may experience

fewer barriers (have more opportunities), and therefore they maybe more likely to perceive that they have control important aspects of their life, including control over exercise.

Consistent with the hypotheses and with most previous research (Cohen et al., 1999; Garcia Bengoechea & Spence, 2002; Garcia Bengoechea, Spence & Fraser, 2005; Ghaed & Gallo, 2007; Iribarren et al., 1997; King et al., 2006; Trost, Owen, Bauman, Sallis, & Brown, 2002; U.S. Department of Health and Human Services, 1996), SES was positively associated with exercise. SES was also positively associated with intentions to engage in exercise. Respondents with greater income and higher social status reported engaging in more exercise behavior, and those with greater income, more education and high social status held stronger intentions to exercise. Occupational status was not associated with exercise behavior or intentions. In North American research, using occupational categories to indicate SES has been criticized (Braveman et al., 2005) as such categories inadequately measure job related SES characteristics. For example, North American occupational categories do not take into account important aspects of the job such as level of responsibility, and one category can include workers with diverse skills, prestige, and earnings (Braveman et al.). Thus, in this study it may be that a diverse range of workers fell under the same job category, and as such the job category failed to differentiate potential occupational difference in exercise intentions and behavior. Additionally, it may simply be that job category is not as critical of a correlate of exercise as income, education, or subjective social status.

Mediation of Behavior and Intentions

Results from the multiple mediation analyses showed that control beliefs mediated the effects of SES (i.e., income, education, social status) on exercise behavior and exercise intentions, with each model explaining approximately 28% of the variance in exercise behavior and 51% of the variance in intentions. Respondents with greater income, higher social status, and more education reported higher levels of perceived control and engaged in moderate effort exercise behavior more often and had higher intentions to engage in moderate effort exercise in the future. Differences in self reported exercise behavior and intentions were related to the tendency for higher SES respondents to have a greater sense of control than lower SES respondents.

These findings are consistent with previous research that has found individuals with lower SES perceive less control over their lives (Bailis et al., 2001; Lachman & Weaver, 1998a; Lachman & Firth, 2004) and over exercise behavior (Clark et al., 1995). Further, other studies also have found that control beliefs mediated (fully or partially) the association between SES and select health behaviors (Legagner & Kraft, 2003) and self-rated health (Bailis et al., 2001; Cohen et al., 1999; Lachman and Weaver 1998a). For example, findings from several studies show that generalized control beliefs mediated the association between SES and self rated health (Bailis et al.; Cohen et al; Lachman & Weaver, 1998a). People with higher SES report more control over their life, and subsequently reported better health. In a study examining fruit and vegetable consumption, Leganaer & Kraft found that generalized and behavioral specific control beliefs partially mediated the relationship between education and intentions, and intentions and education both predicted behavior.

To some extent, differences in control beliefs in lower SES groups may be realistic and reflect actual disparity in life situations among social class groups (Lachman & Weaver, 1998a). People with lower income, education and social status may have fewer opportunities to influence events that affect their lives (Lachman & Weaver), and may experience more obstacles and barriers performing health related behaviors (Williams, 1992), including exercise (Clark et al., 1995). Limited resources may discourage participation in fitness classes and may prevent people from being able to purchase exercise related equipment for home use (Clark et al.). Activities such as walking still require adequate opportunity, including a safe and pleasant environment with which to walk in. Differences in exercise behavior and intention across SES levels may reflect the extent to which environments constrain or promote specific health behaviors (Adler & Snibbe). The social environment of lower SES individuals may be more likely to promote unhealthy behaviors through advertizing and the promotion of unhealthy coping strategies (Williams). In terms of exercise behavior, lower SES neighborhoods have fewer free resources and facilities than higher SES neighborhoods (Estabrooks, Lee & Gyurcsik, 2003). Thus, lower SES contexts may present fewer opportunities for control and for participation in health promoting behaviors (Adler & Snibbe, 2003), and as such it is not necessarily surprising that individuals with lower SES reported less control and less exercise than respondents with higher SES.

The results of the current study also suggest that different control beliefs may be important in the determination of behavioral intentions and behavior. Coping self-efficacy beliefs were a key predictor of both moderate effort exercise and intentions to engage in moderate effort exercise. However, moderate effort exercise behavior was also

predicted by a low level of personal constraints, whereas intention to exercise was also predicted by higher levels of PBC over exercise. Thus, generalized control beliefs appear to play an important role in behavior, but not for intentions. Behavioral specific control beliefs seem to be key for intention formation, not generalized control beliefs.

Perhaps when people are cognitively engaged in intention formation, especially for very specific exercise intentions like in this study (i.e., moderate effort exercise), aspects of exercise and the exercise related environment (e.g., fitness centre, running shoes) are more salient than general factors surrounding their broader life. That is, when people are responding to how strongly they intend to engage in moderate effort exercise, they may be thinking if they have all the things they need specifically for their exercise. However, for actual enactment of the behavior a variety of other factors probably come into play, including factors which surround their broader life. People may perceive that they have control over the behavior (or aspects of the behavior, for example they may have access to a fitness facility), but other obstacles or barriers in their life (working late, family responsibilities) may prevent behavioral enactment. In such circumstances, behavioral control beliefs may be necessary but not sufficient, for performance of certain health behaviors, such as moderate effort exercise behavior. Generalized control beliefs, specifically beliefs that reflect potential constraints or barriers in general, appear to play an important role in moderate effort exercise behavior.

Additionally, both personal constraints and PBC reflect the existence of external constraints (although arguably PBC to a lesser extent than constraints). Coping self-efficacy, a type of barrier efficacy, also was a significant mediator of intention and behavior. Thus, in the current study, control beliefs surrounding 'barriers' seem to play a

key role. While perceiving control over life and over the ability to perform the exercise is important (as evidenced by the correlations), results seem to suggest that control beliefs relating to barriers or constraints in people's lives and in life domains such as exercise, play a key role in intention formation and behavioral enactment.

There were a number of limitations inherent in the current study. The data include only one observation of each variable, and as such it is not possible to determine the sequence of events that may have led to the observed relationships. Any causal interpretation implied by the theoretical model should be viewed cautiously, due to the cross sectional nature of this research study. Select demographic variables (e.g., age, marital status) also were not controlled for in the analyses, which may have increased the association between SES, control beliefs and exercise in the current study. Further, there was a relatively low response rate, and the sample was self-selected volunteers living in select neighborhoods in the city of Edmonton. This sample had higher median income levels ($70 000 compared to $57 000) and higher levels of education as compared to recent estimates for the city of Edmonton (Statistics Canada, 2008). As SES is positively associated with increased physical activity and exercise, this bias has implications for the results found in this study. Different results may have been found if a more representative sample had been used. Therefore, the findings may only be generalizable to those who completed this study. Additionally, this study relied on a self-report measure of behavior, and only assessed moderate effort exercise. Research has shown that the absence of intensity categories (in this case mild and strenuous) can create problems with reporting of exercise (Courneya, Jones, Rhodes & Blanchard, 2004). For example, participants reported more minutes of moderate exercise when mild exercise

was not assessed (Courneya et al.). Thus, in the current study participants may have been more likely to over report moderate effort exercise. Future research may benefit from assessing mild, moderate and strenuous exercise intensities and from more objective indicators of exercise, (e.g., pedometers, accelerometers attendance to fitness classes). This study also only examined control beliefs as a potential mediator between the relation of SES and exercise behavior. Although control beliefs have received attention as one key mechanism in the relation between SES and health status (Adler & Snibbe, 2003; Marmot, 2006), without doubt, there are many other potential mediators in the relation between SES and select health behaviors, including personal and environmental factors.

Additionally, there were moderate to high correlations between the control variables (and between the SES variables). Although there was no formal indication of multicollinearity (i.e., condition index and variance inflation factors) among the variables, the correlations suggest they are, in some instances, highly related. Multicollinearity is problematic in regression analyses as it severely limits the size of R, can lead to an unstable prediction equation and confounds the effects of the predictor variables, thereby potentially masking the effects of certain predictors, making if difficult to determine the importance of any given variable (Stevens, 2002). Thus, it is possible, for example, that in the hierarchical linear regression other SES indicators were also important predictors of intentions and behavior, but their effect was masked due to the correlations among them. The same may also be true for the control variables in both the hierarchical linear regression and the mediation analyses. Finally, the current study did not address the possibility of potential gender differences. Past research shows that men often report more exercise than women (Brownson, Boehmer & Luke, 2005; Capital

Health, 2002; King et al., 2006; US Department of Health and Human Services, 1996). Further, some studies have reported that men have higher self-efficacy for exercise than women (Garcia Bengoechea et al., 2005; Clark & Nothwehr, 1999), as well as higher levels of perceived mastery (Lachman & Weaver, 1998a). Thus, exploring for potential gender differences seems prudent.

Despite the limitations, the current results may contribute to our understanding of the different kinds of control, and their role in the relation between SES and exercise behavior. Mastery, self-efficacy, and PBC could all be distinguished from each other, and showed different associations to intentions and behavior. While coping self-efficacy was a key correlate of both intention and behavior, results suggest that generalized control beliefs share important associations with exercise behavior, whereas PBC emerged as key for intentions. Further, results from this study showed that SES differences in self reported moderate exercise behavior and intentions were related to perceptions of control. People with lower SES reported lower levels of perceived control and were less likely to engage in moderate effort exercise behavior and had lower intentions to exercise in the future. Future research should continue to examine the role of generalized control beliefs in exercise behavior (and with other health behaviors). Perhaps the well known 'intention-behavior gap' could be reduced if our models included more generalized beliefs. The practical significance of these findings is in the potential to help guide future psychosocial exercise interventions, which may need to focus on control beliefs that surround broader areas of life in conjunction with exercise specific beliefs, notably coping self-efficacy.

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Table 2-1. Demographic profile of respondents ($N = 351$)

Variable	*M* (*SD*) or *n* (%)
Age	48.49 (16.05)
Body Mass Index	25.80 (5.29)
Health Status	3.58 (.94)
Condition Limiting Exercise	
Yes	74 (21.0%)
No	279 (79.0%)
Sex	
female	229 (65.4%)
male	121 (34.3%)
missing	1 (.3%)
Number of people living in household	
1	57 (16.2%)
2	131 (37.3%)
3	55 (15.7%)
4	74 (21.1%)
5	21 (6.0%)
6	12 (3.4%)
7	1 (.3%)
Employment Status	
Full time	161 (45.9%)
Part time	44 (12.5%)
Self-employed	52 (14.8%)
Homemaker	14 (4.0%)
Unemployed	14 (4.0%)
Retired	66 (18.8%)
Education	
Less than high school	40 (11.4%)
High school diploma	55 (15.7%)
Some college/university	76 (21.7%)
College/university degree	180 (51.3%)
Occupation	
Elementary occupations	18 (5.1%)
Plant and machine operators	8 (2.3%)

Craft and trade workers	28 (8.0%)
Agricultural and fishery workers	0 (0.0%)
Service, shop and market sales workers	43 (12.3%)
Clerks	58 (16.5%)
Technicians and associate professionals	75 (21.4%)
Professionals	89 (25.4%)
Legislators, senior officials and managers	10 (2.8%)
Missing	22 (6.3%)
Household Income	
No income	3 (.8%)
$5 000 – $9 999	6 (1.7%)
$10 000 - $14 999	4 (1.1%)
$15 000 - $19 999	10 (2.8%)
$20 000 - $29 999	21 (5.9%)
$30 000 – $39 999	32 (9.1%)
$40 000 - $49 999	35 (10.0%)
$50 000 - $59 999	30 (8.5%)
$60 000 - $79 999	58 (16.4%)
$80 000 - $99 999	39 (11.1%)
$100 000 - $119 999	39 (11.1%)
$120 000 - $149 999	25 (7.1%)
$150 000 or more	49 (14.0%)

Table 2-2. Descriptive statistics of study variables.

Variable	*M*	*SD*	Skewness (*SE*)	Kurtosis (*SE*)
1. Age	48.49	16.06	.19 (.13)	-.56 (.26)
2. Gender	1.35	.48	-	-
3. BMI	25.80	5.29	1.57 (.13)	4.05 (.26)
4. Health Status	3.58	.94	-.01 (.13)	-.71 (.26)
5. Income* (dollars)	50118.04	27382.78	.67 (.13)	.29 (.26)
6. Education	3.12	1.05	-.85 (.13)	-.64 (.26)
7. Occupation	6.10	2.06	-1.03 (.13)	.26 (.26)
8. Social Status	6.22	1.64	-.05 (.13)	-.07 (.26)
9. Mastery	5.59	.96	-.71 (.13)	.27 (.26)
10. Constraints	2.74	1.12	.80 (.13)	.33 (.26)
11. Task SE	76.18	23.23	-1.38 (.13)	1.45 (.26)
12. Cope SE	56.24	26.08	-.31 (.13)	-.77 (.26)
13. PBC	5.95	1.16	-1.32 (.13)	1.67 (.26)
14. Intentions	5.24	1.72	-.79 (.13)	-.50(.26)
15. Exercise Time (mins)	164.98	152.24	1.79 (.13)	5.41 (.26)

Note. * income adjusted for household size.

Table 2-3. Pattern coefficients, internal consistencies and communality estimates from principal axes analysis of control items.

Items	Factors I	II	III	IV	V	h^2
Coping Self-efficacy (α = .92)						
Exercise when I lack energy	.64					.67
Include exercise in my daily routine	.83					.77
Consistently exercise every day of the week	.92					.73
Exercise when I don't feel well	.78					.54
Arrange my schedule to include exercise	.75					.76
Personal Constraints (α = .85)						
Other people determine most of what I can and can not do		.54				.32
I have little control over the things that happen to me		.72				.47
What happens in my life is often beyond my control		.73				.49
I sometimes feel I am being pushed around in life		.72				.55
There is little I can do to change most of the important things in life		.79				.66
I often feel helpless in dealing with the problems in my life		.66				.55
There are many things that interfere with what I want to do		.54				.36
There is really no way I can solve some of the problems I have		.51				.27
Perceived Behavioral Control (α = .89)						
I believe I have the resources required to exercise			.89			.74
I believe I have the opportunities to exercise			.85			.64
I believe I have all the things I need to exercise			.87			.74
I am confident that I can exercise			.62			.63
I have control over exercising			.61			.55
Task Self-efficacy (α = .92)						
Complete exercise using proper technique				.73		.84
Follow directions to complete my exercise				.84		.69
Perform all of the movements required for my exercise				.75		.80
Perceived Mastery (α = .73)						
I can do just about anything I set my mind to					.64	.50
What happens to me in the future mostly depends on me					.43	.25
When I really want to do something, I usually find a way to succeed					.71	.47
Whether or not I am able to get what I want is in my own hands					.72	.51
% Variance	35.86	9.45	5.30	4.21	3.11	

Table 2-4. Correlations among study variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	-													
2. Gender	**.20**	-												
3. BMI	**.14**	.07	-											
4. Health Status	-.05	.09	**-.31**	-										
5. Income*	.04	.10	**-.13**	**.33**	-									
6. Education	**-.11**	**-.12**	**-.14**	**.24**	**.34**	-								
7. Occupation	-.03	**-.21**	**-.15**	**.14**	**.27**	**.50**	-							
8. Social Status	.07	**.15**	-.08	**.37**	**.50**	**.41**	**.24**	-						
9. Mastery	**-.25**	.05	-.10	**.32**	**.11**	.01	-.02	**.15**	-					
10. Constraints	.09	-.05	**.11**	**-.40**	**-.26**	**-.21**	**-.17**	**-.35**	**-.38**	-				
11. Task SE	**-.24**	-.01	**-.22**	**.44**	**.33**	**.26**	**.15**	**.35**	**.45**	**-.34**	-			
12. Cope SE	.00	**.12**	**-.20**	**.44**	**.25**	**.15**	.07	**.26**	**.40**	**-.37**	**.68**	-		
13. PBC	-.03	.03	**-.25**	**.42**	**.26**	**.23**	**.12**	**.39**	**.37**	**-.45**	**.57**	**.58**	-	
14. Intentions	.01	.09	**-.17**	**.46**	**.25**	**.22**	.10	**.34**	**.29**	**-.29**	**.50**	**.68**	**.55**	-
15. Exercise (mins)	-.04	**.17**	**-.20**	**.36**	**.17**	.08	.05	**.15**	**.20**	**-.30**	**.38**	**.53**	**.32**	**.47**

Note: r's in bold are significant; all r's >.11, p <.05; all r's >.15, p < .01. *Income adjusted for family size

Table 2-5. Prediction of Intentions from Control Variables (N = 343)

Variables	*B*	*SE B*	β	R^2	ΔR^2
Subset 1					
Behavior	.01	.00	.47***	.22	
Subset 2					
Behavior	.01	.00	.40***	.27	.05***
Mastery	.29	.09	.16**		
Constraints	-.17	.08	-.11*		
Subset 3				.48	.27***
Behavior	.00	.00	.15**		
Task SE	.00	.00	.05		
Cope SE	.03	.00	.57***		
Subset 4				.40	.18***
Behavior	.00	.00	.32***		
PBC	.67	.07	.45***		
Subset 5				.48	.21***
Behavior	.00	.00	.15**		
Mastery	.05	.08	.03		
Constraints	-.02	.07	-.01		
Task SE	.00	.00	.04		
Cope SE	.04	.00	.56***		
Subset 6				.40	.13***
Behavior	.00	.00	.32***		
Mastery	.12	.08	.07		
Constraints	.05	.08	.03		
PBC	.65	.07	.44***		
Subset 7				.52	.04***
Behavior	.00	.00	.14**		
Task SE	.00	.00	-.02		
Cope SE	.03	.00	.48***		
PBC	.35	.07	.24***		
Subset 8				.51	.04***
Behavior	.00	.00	.15**		
Mastery	.03	.08	.02		
Constraints	.07	.07	.05		
Task SE	.00	.00	-.03		

Cope SE	.03	.00	.49***
PBC	.37	.08	.25***

Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = perceived behavioral control.
*$p < .05$; **$p < .01$; ***$p < .001$

Table 2-6. Prediction of Behavior from Control Variables (N = 343)

Variables	*B*	*SE B*	β	R^2	ΔR^2
Subset 1				.10	
Mastery	15.69	8.66	.09		
Constraints	-35.50	7.46	-.26***		
Subset 2				.28	
Task SE	.30	.41	.05		
Cope SE	2.92	.37	.50***		
Subset 3				.10	
PBC	42.08	6.72	.32***		
Subset 4				.29	.19***
Mastery	-.6.73	8.60	-.04		
Constraints	-16.45	7.14	-.12*		
Task SE	.26	.43	.04		
Cope SE	2.79	.38	.47***		
Subset 5				.13	.03***
Mastery	8.10	8.86	.05		
Constraints	-23.11	8.07	-.17**		
PBC	29.70	7.64	.23***		
Subset 6				.28	.00
Task SE	.28	.43	.04		
Cope SE	2.90	.39	.49***		
PBC	1.27	7.79	.01		
Subset 7				.29	.00
Mastery	-6.51	8.63	-.04		
Constraints	-17.24	7.40	-.12*		
Task SE	.31	.44	.05		
Cope SE	2.83	.39	.48***		
PBC	-.3.37	8.09	-.03		

Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = perceived behavioral control.
*$p < .05$; **$p < .01$; ***$p < .001$

Table 2-7. Summary of Hierarchical Regression Analyses for SES and Control Beliefs Predicting Exercise (n = 320)

Variables	R	R^2_{adj}	β_1	p	β_2	p	β_3	p	β_4	p
Step 1	.19	.02								
Income			.15	.03	.13	.05	.05	.38	.05	.39
Education			-.02	.82	-.01	.87	-.03	.61	-.03	.63
Occupation			-.01	.89	-.02	.79	-.01	.86	-.01	.85
Social Status			.07	.27	-.01	.94	-.03	.60	-.03	.66
Step 2	.32	.08								
Mastery					.11	.07	-.05	.39	-.05	.42
Constraints					-.21	.00	-.13	.03	-.13	.03
Step 3	.54	.27								
Task Self-efficacy							.06	.37	.07	.34
Coping Self-efficacy							.45	.00	.46	.00
Step 4	.54	.27								
PBC									-.03	.69

Note: $F_{Step\ 1}(4, 316) = 2.82, p = .03$; $F_{Step\ 2}(6, 314) = 5.88, p < .001$; $F_{Step\ 3}(8, 312) = 15.69, p < .001$; $F_{Step\ 4}(9, 311) = 13.92, p < .001$; $F\Delta_{Step\ 2}(2, 314) = 11.62, p < .001$; $F\Delta_{Step\ 3}(2, 312) = 40.63, p < .001$; $F\Delta_{Step\ 4}(1, 311) = .16, p = .69$

Table 2-8. Summary of Hierarchical Regression Analyses for SES and Control Beliefs Predicting Exercise Intentions ($n = 320$)

Variables	R	R^2_{adj}	β_1	p	β_2	p	β_3	p	β_4	p
Step 1	.36	.12								
Income			.11	.09	.08	.17	-.01	.91	.01	.89
Education			.09	.19	.10	.12	.08	.11	.07	.18
Occupation			-.04	.54	-.03	.55	-.02	.61	-.02	.69
Social Status			.26	.00	.21	.00	.18	.00	.14	.00
Step 2	.45	.19								
Mastery					.24	.00	.06	.25	.03	.46
Constraints					-.07	.19	.04	.43	.07	.12
Step 3	.71	.49								
Task Self-efficacy							.00	.96	-.03	.51
Coping Self-efficacy							.62	.00	.54	.00
Step 4	.73	.51								
PBC									.22	.00

Note: $F_{Step\ 1}(4, 316) = 11.73, p < .001$; $F_{Step\ 2}(6, 314) = 13.28, p < .001$; $F_{Step\ 3}(8, 312) = 39.36, p < .001$; $F_{Step\ 4}(9, 311) = 38.45, p < .001$; $F\Delta_{Step\ 2}(2, 314) = 14.38, p < .001$; $F\Delta_{Step\ 3}(2, 312) = 93.99, p < .001$; $F\Delta_{Step\ 4}(1, 311) = 16.17, p < .001$

Table 2-9. Indirect Effects of SES on Exercise Behavior Through Control Beliefs.

	Product of Coefficients			Bootstrapping			
				Percentile 95% CI		BC 95% CI	
	Point Estimate	*SE*	Z	Lower	Upper	Lower	Upper
			Income ($N = 343$)				
Mastery	-.0049	.0081	-.605	-.0233	.0106	-.0271	.0078
Constraints	.0309	.0124	2.491*	.0087	.0595	.0093	.0609
Task SE	.0138	.0206	.669	-.0279	.0558	-.0273	.0568
Cope SE	.1200	.0320	3.75**	.0617	.1926	.0643	.1976
PBC	-.0068	.0142	-.486	-.0366	.0219	-.0393	.0196
TOTAL	.1530	.0307	4.983**	.0958	.2189	.0957	.2189
			Education ($N = 343$)				
Mastery	-.0010	.0045	-.222	-.0141	.0058	-.0183	.0039
Constraints	.0238	.0112	2.125*	.0058	.0504	.0068	.0524
Task SE	.0137	.0182	.757	-.0188	.0498	-.0164	.0525
Cope SE	.0715	.0287	2.491*	.0169	.1366	.0212	.1444
PBC	-.0051	.0128	-.398	-.0367	.0196	-.0390	.0180
TOTAL	.1029	.0347	2.965*	.0334	.1751	.0368	.1790
			Occupation ($N = 321$)				
Mastery	.0002	.0040	.050	-.0094	.0092	-.0070	.0120
Constraints	.0194	.0103	1.883	.0038	.0411	.0052	.0446
Task SE	.0103	.0110	.9363	-.0104	0341	-.0046	.0429
Cope SE	.0334	.0312	1.070	-.0226	.0980	-.0198	.1016
PBC	-.0041	.0089	-.461	-.0248	.0104	-.0318	.0071
TOTAL	.0593	.0345	1.718	-.0102	.1268	-.0065	.1307
			Subjective Social Status ($N = 343$)				
Mastery	-.0071	.0110	-.645	-.0336	.0124	-.0361	.0101
Constraints	.0497	.0179	2.776*	.0151	.0889	.0151	.0889
Task SE	.0185	.0231	.801	-.0249	.0664	-.0236	.0690
Cope SE	.1280	.0371	3.450**	.0616	.2082	.0678	.2176
PBC	-.0080	.0237	-.338	-.0553	.0359	-.0567	.0347
TOTAL	.1810	.0384	4.713**	.1069	.2583	.1083	.2594

Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. BC = bias corrected; 1000 bootstrap samples.

*$p < .05$, **$p < .001$

Table 2-10. Indirect Effects of SES on Exercise Intentions Through Control Beliefs.

	Product of Coefficients			Bootstrapping			
				Percentile 95% CI		BC 95% CI	
	Point Estimate	*SE*	Z	Lower	Upper	Lower	Upper
			Income ($N = 343$)				
Mastery	.0019	.0058	.327	-.0089	.0152	-.0068	.0192
Constraints	-.0118	.0104	-1.134	-.0348	.0064	-.0355	.0061
Task SE	-.0120	.0185	-.648	-.0501	.0239	-.0538	.0203
Cope SE	.0795	.0234	3.397**	.0360	.1274	.0387	.1309
PBC	.0513	.0171	3.000*	.0229	.0896	.0251	.0938
TOTAL	.1089	.0303	3.594**	.0500	.1685	.0533	.1722
			Education ($N = 343$)				
Mastery	.0002	.0035	.057	-.0061	.0092	-.0053	.0102
Constraints	-.0097	.0082	-1.182	-.0283	.0041	-.0306	.0027
Task SE	.0121	.0160	.756	-.0466	.0168	-.0518	.0137
Cope SE	.0533	.0244	2.184*	.0071	.1028	.0082	.1039
PBC	.0483	.0195	2.476*	.0166	.0926	.0188	.0988
TOTAL	.0800	.0322	2.484*	.0179	.1441	.0177	.1440
			Occupation ($N = 321$)				
Mastery	-.0002	.0032	-.062	-.0270	.0072	-.0104	.0045
Constraints	-.0070	.0074	-.945	-.0241	.0058	-.0275	.0034
Task SE	-.0016	.0098	-.163	-.0234	.0170	-.0275	.0158
Cope SE	.0227	.0238	.953	-.0250	.0710	-.0248	.0715
PBC	.0275	.0176	1.56	-.0024	.0673	.0003	.0723
TOTAL	.0414	.0354	1.17	-.0269	.1136	-.0271	.1131
			Subjective Social Status ($N = 343$)				
Mastery	.0039	.0079	.494	-.0106	.0224	-.0072	.0266
Constraints	-.0288	.0161	-1.79	-.0621	.0022	-.0626	.0020
Task SE	-.0183	.0207	-.884	-.0632	.0197	-.0669	.0173
Cope SE	.0929	.0287	3.236**	.0406	.1529	.0424	.1563
PBC	.0764	.0250	3.056*	.0303	.1284	.0350	.1366
TOTAL	.1260	.0382	3.298**	.0525	.2015	.0553	.2062

Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. BC = bias corrected; 1000 bootstrap samples.
* $p < .05$, ** $p < .001$

Figure 2-1. Flow of participants through the study

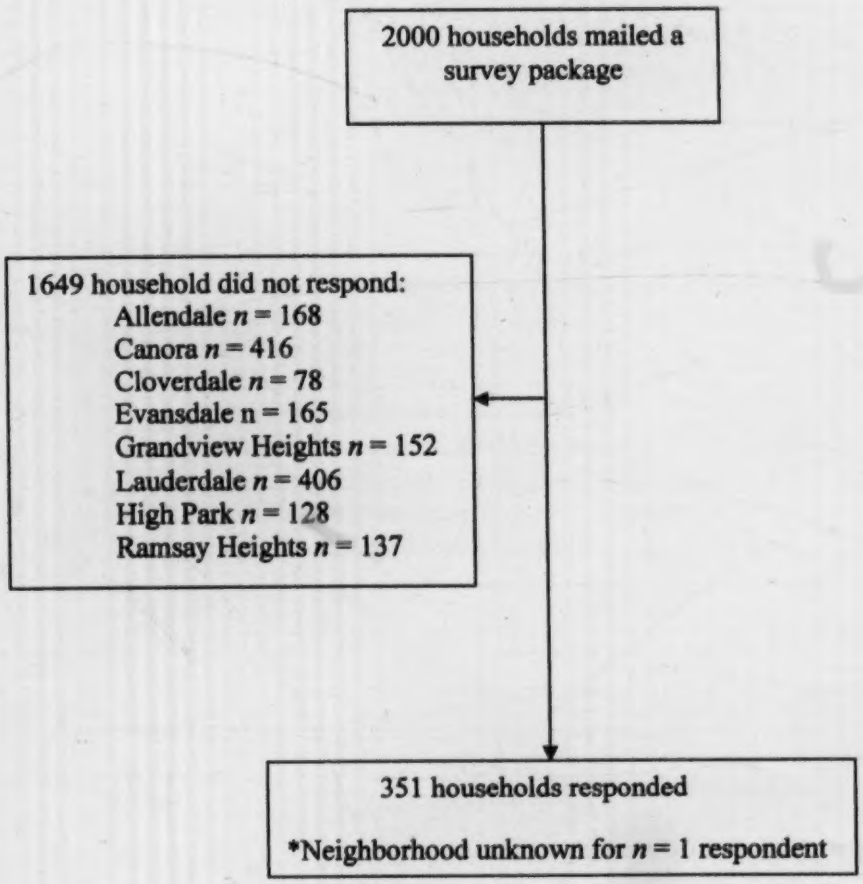
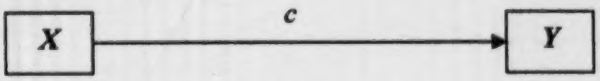

2000 households mailed a survey package
1649 household did not respond:
Allendale n = 168
Canora n = 416
Cloverdale n = 78
Evansdale n = 165
Grandview Heights n = 152
Lauderdale n = 406
High Park n = 128
Ramsay Heights n = 137
351 households responded
*Neighborhood unknown for n = 1 respondent

Figure 2-2. Panel A: Illustration of direct effect of X on Y (c path). Panel B: Illustration of a simple mediation design. X is hypothesized to effect Y indirectly through M. (Preacher & Hayes, 2007)

A



B

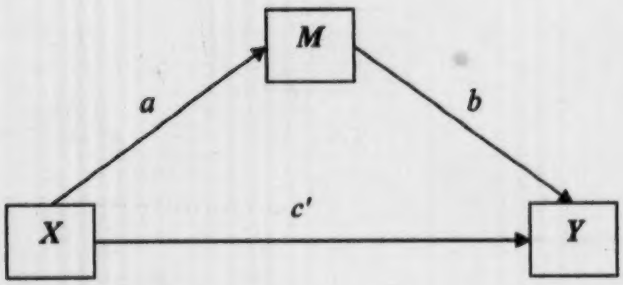
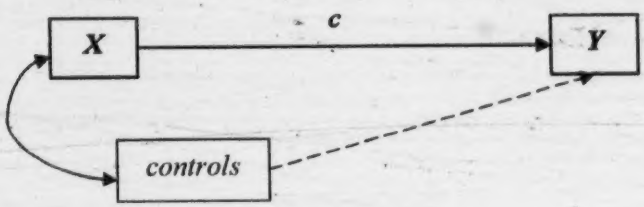


Figure 2-3. Illustration of a multiple mediator model with 4 mediators. *X* is hypothesized to effect *Y* through M_1... M_4, and the specific indirect effect of *X* on *Y* through M_1 is a_1b_1. (Preacher & Hayes, 2007)



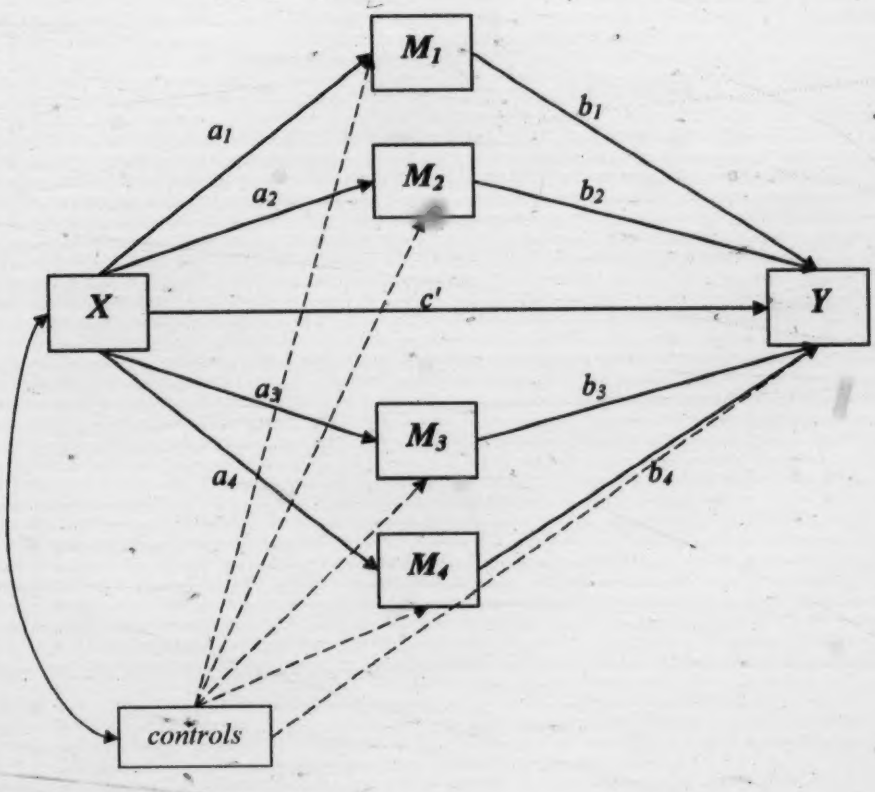
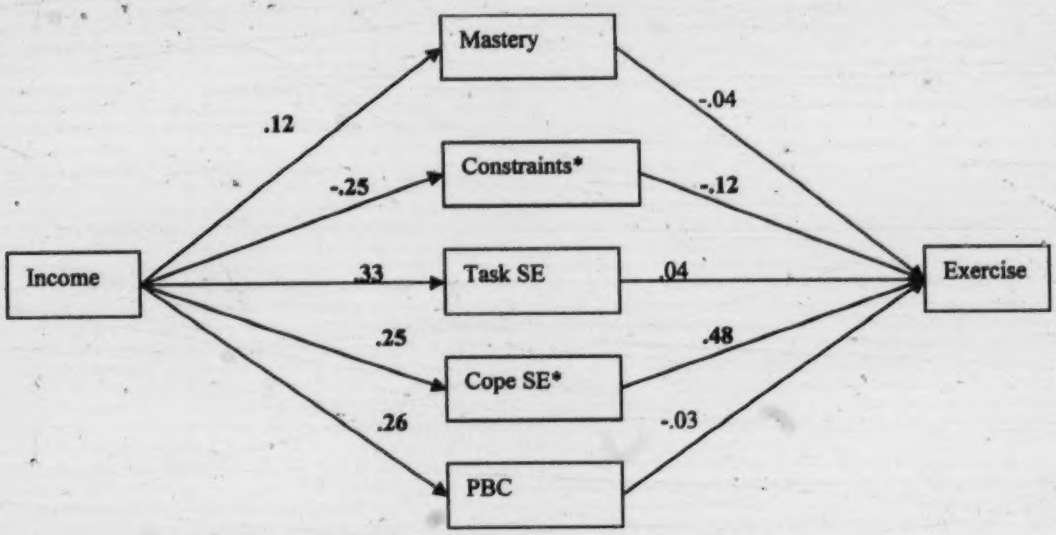
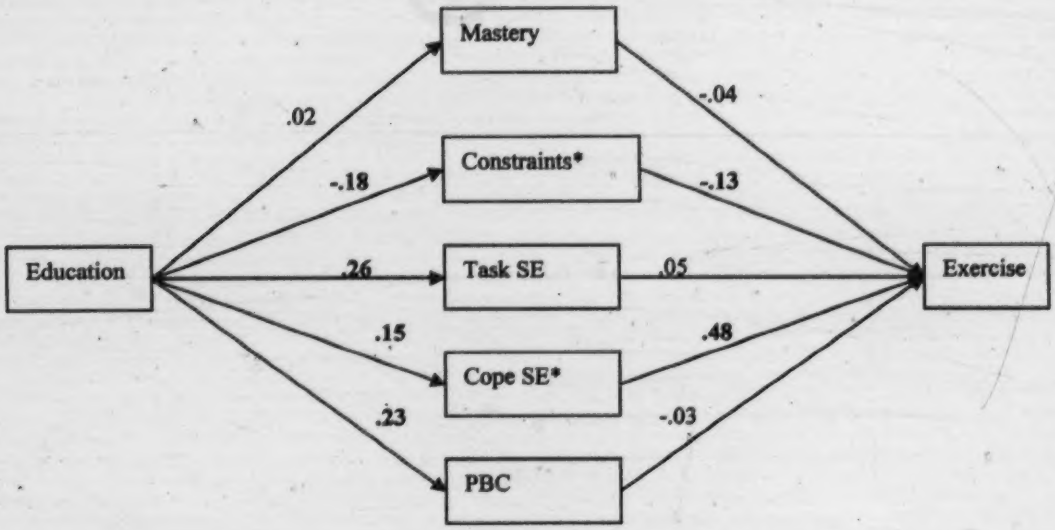


Figure 2-4. Direct effects model of income on exercise through control beliefs.



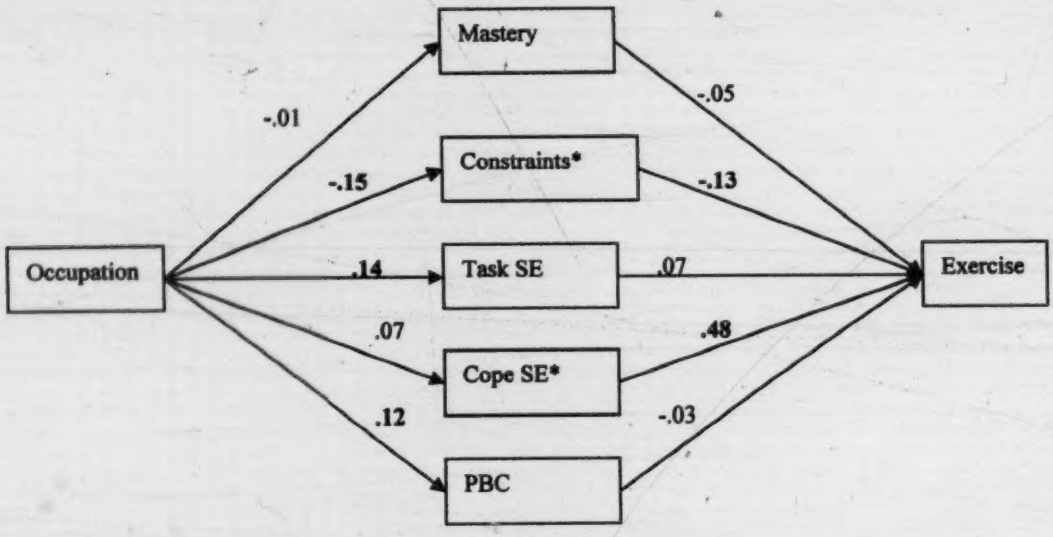
Note. Task SE =task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$.
*denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-5. Direct effects model of education on exercise through control beliefs.



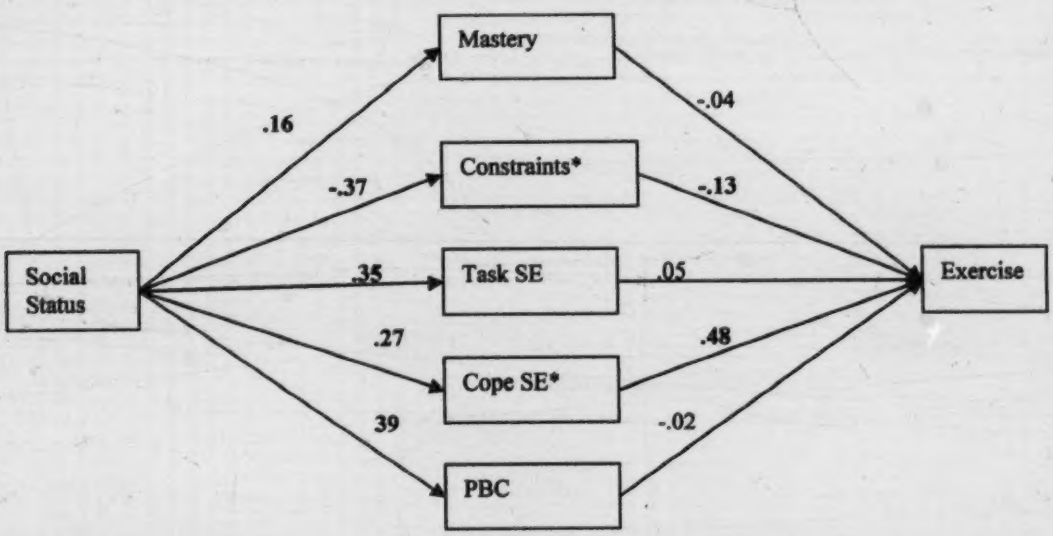
Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$;
*denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-6. Direct effects model of occupation on exercise through control beliefs.



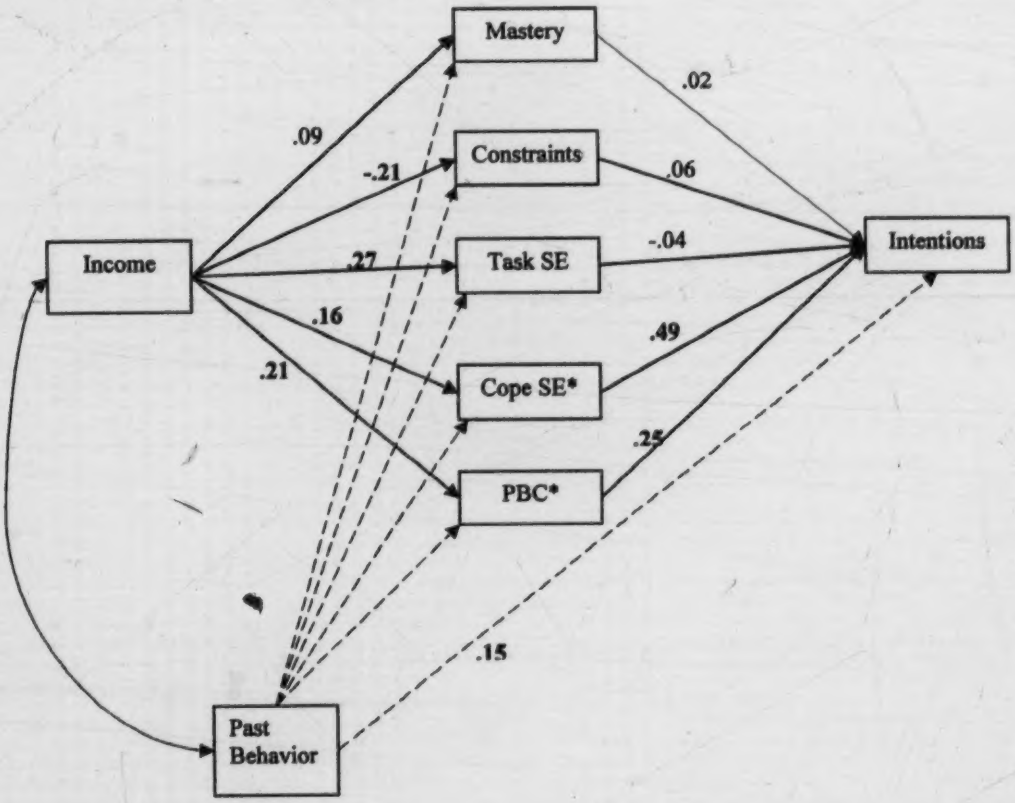
Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$.
*denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-7. Direct effects model of social status on exercise through control beliefs.



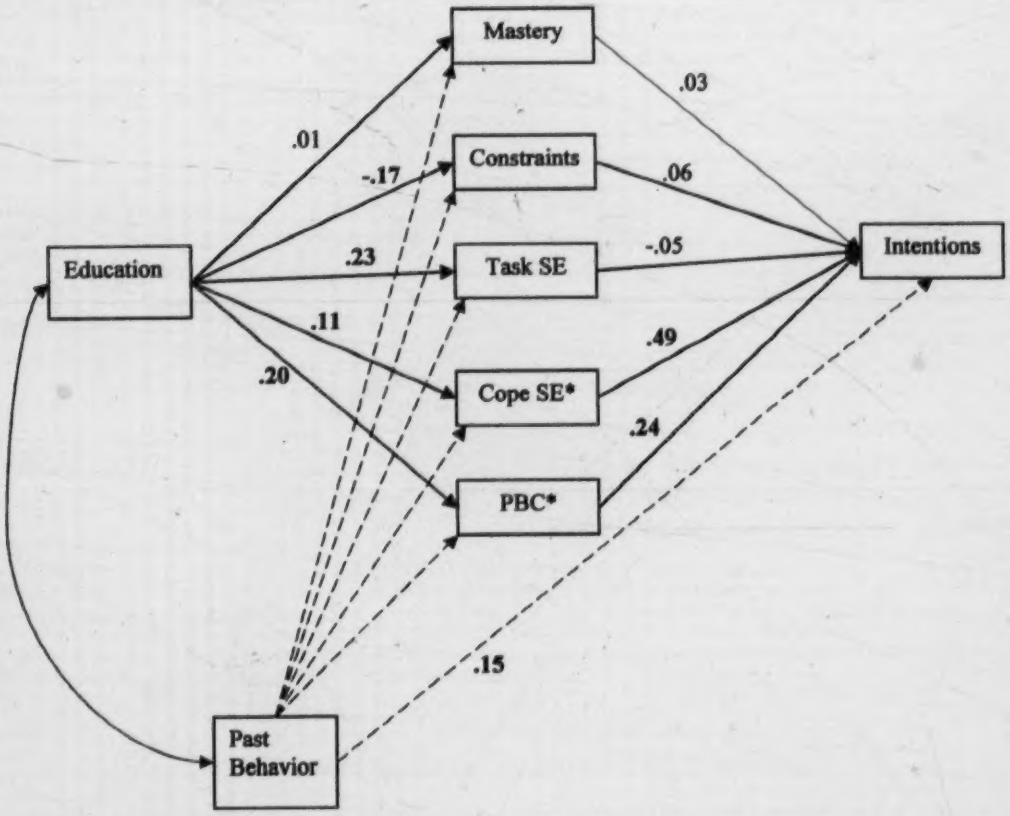
Note. Task SE= task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$.
*denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-8. Direct effects model of income on exercise intentions through control beliefs, controlling for past behavior.



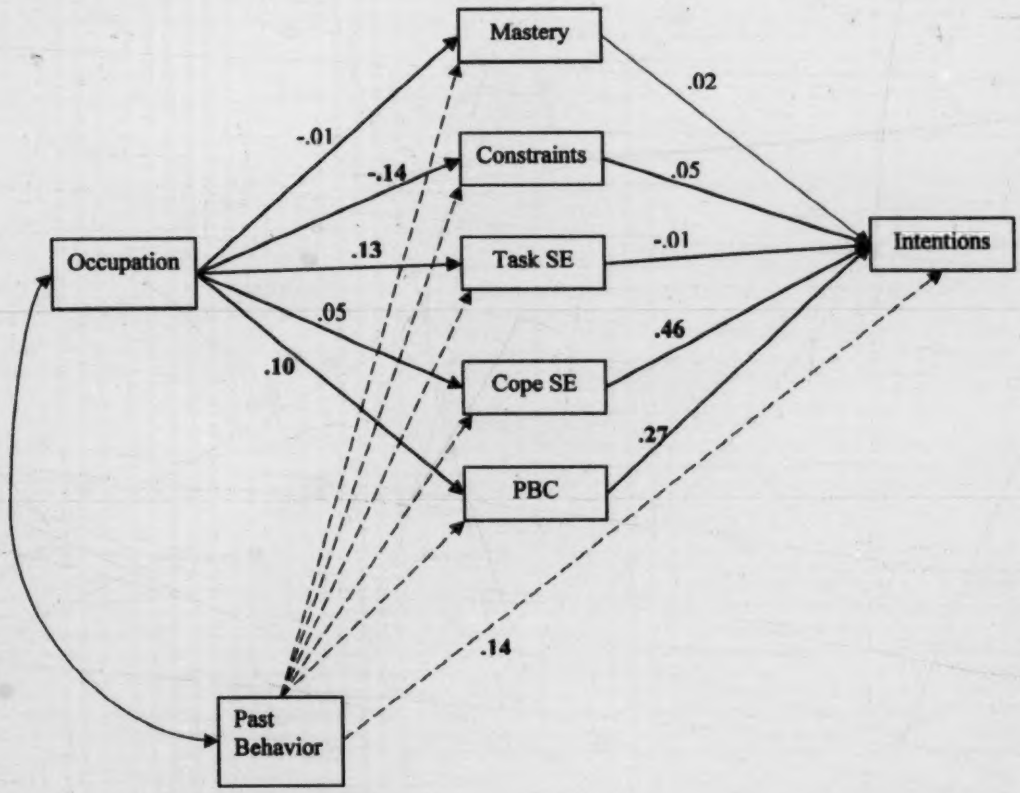
Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$; *denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-9. Direct effects model of education on exercise intentions through control beliefs, controlling for past behavior.



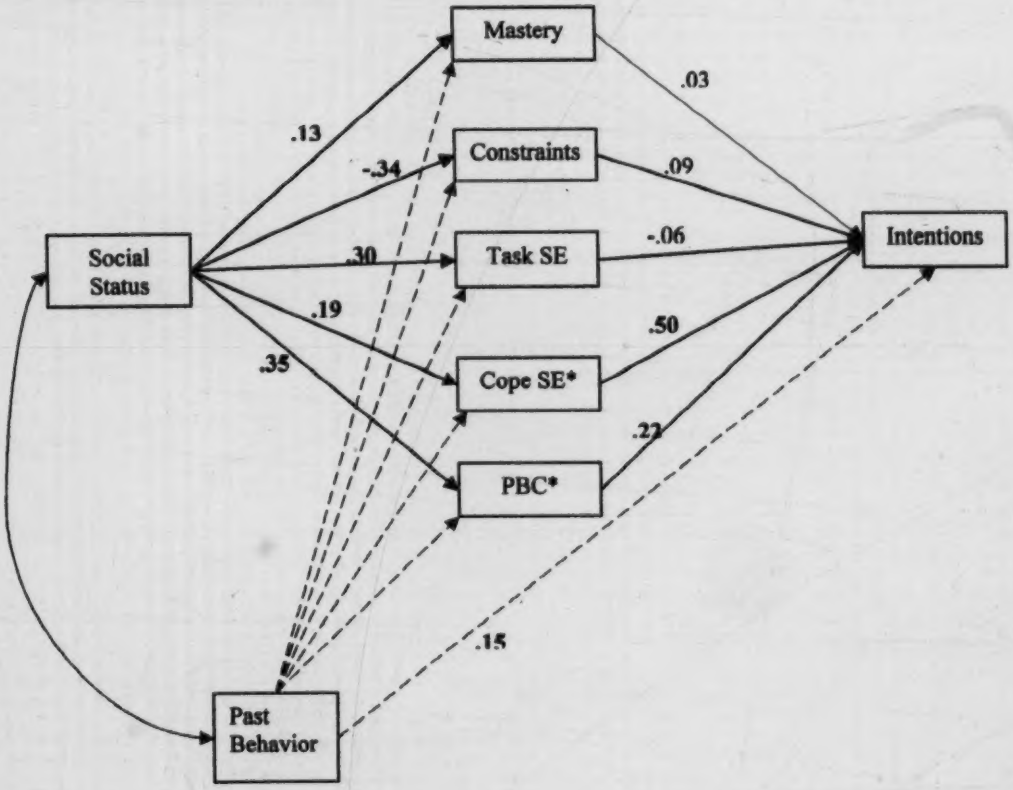
Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$; *denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-10. Direct effects model of occupation on exercise intentions through control beliefs controlling for past behavior.



Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$; *denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Figure 2-11. Direct effects model of social status on exercise intentions through control beliefs, controlling for past behavior.



Note. Task SE = task self-efficacy. Cope SE = coping self-efficacy. PBC = Perceived behavioral control. Coefficients in bold are significant at $p < .05$; *denotes that the indirect effect of the variable was significant (i.e., variable acts as a mediator).

Appendix 2-A

Information Letter

Title of Study: Influences on physical activity behavior in people living in Edmonton.

Researchers: Ms. Terra Murray, 492-7424 Dr. Wendy Rodgers, 492-2677

Faculty of Physical Education and Recreation
P-426 Pavilion
University of Alberta, T6G 2H9

Dear community resident,

We are researchers from the University of Alberta. We are asking people from different neighborhoods in Edmonton to participate in a research study. We know that being active and exercising is important for health. But "things" might make it easier for some people to exercise and harder for other people to exercise. We want to know more about those "things".

If you want be in this study, please complete the pink survey. It should take no more than 10 minutes to finish. The survey will ask questions about your life (the kind of work you do). It will also ask about how you feel about life and about exercise. Once you finish the survey, put it in the envelope we gave you and drop it in the mailbox. It will be returned back to us. Completing and returning the survey is the only thing you have to do to be a part of this study. If you do not want to be in the study, simply do not complete the survey.

Sometimes people do not like to answer questions about their personal situation. Sometimes people do not like to answer questions about exercise. We know that. But we would like to tell you that the information you can give us is very important to our study. We need you to tell us how things really are.

You do not need to put your name on this survey. All information you provide is kept private. No one except Terra Murray and Wendy Rodgers will have access to study information. When you return the survey, it is kept in a locked lab at the University of Alberta. When we talk about the study, we will only talk about group results (people who live in Edmonton), not about individual results.

As researchers, we need to explain the benefits and risks of being in this study. There are no risks to being in this study. But there is also little benefit to you. We can not offer you anything for being in the project. But the information you give by completing the survey will help us make this a worthwhile and meaningful project – so thank you. We hope that this information will us understand the things that make it harder (or easier) for some people to exercise.

If you have any questions about the survey, call Terra Murray at 492-7424, or Wendy

Rodgers at 492-2677. If you have concerns about this study, you may contact Dr. Brian Maraj, Chair of the Faculty Research Ethics Board, at 492-5910. Dr. Maraj has no direct involvement with this project.

Sincerely,
Terra Murray

Appendix 2-B

1. What is your:

Age _____ Height _____ Weight _____ Sex: O Male O Female

2. Including you, how many people live at your house? _____ (number of people)

3. Do you have any physical limitations that limit how much you can exercise?

O Yes O No

4. In general, would you say your health is:

O Poor O Fair O Good O Very Good O Excellent

5. Which of the following is your best guess of the **total income**, before taxes and deductions of **all household members** from all sources in the past year?

O No Income
O $5000 - $9999
O $10, 000 – $14, 999
O $15,000 – $19, 999
O $20,000 – $29, 999
O $30,000 – $39, 999
O $40,000 – $49, 999
O $50,000 – $59, 999
O $60,000 – $79, 999
O $80,000 – $99, 999
O $100,000 - $119, 999
O $120, 000 – 149, 999
O $150, 000 or more

6. What is your highest level of education?

O Less than a high school diploma
O A high school diploma
O Some college or University
O A college or university degree

7. Which of the following best describes your current employment status?

O Employed Full-Time
O Employed Part-time
O Homemaker
O Self-employed
O Unemployed
O Retired

8. Think of this ladder as representing where people stand in society.

At the top of the ladder are the people who are best off-those Who have the most money, most education and the best jobs. At the bottom are the people who are worst off-who have the Least money, least education and the worst jobs or no job. The higher up you are on this ladder, the closer you are to people at the very top and the lower you are, the closer you are to the bottom.

Where would you put yourself on the ladder?

Please place a large 'X' on the rung where you think you stand.

These questions concern your plans and thoughts for exercise. Exercise, means being active at a moderate effort level (brisk walking, light weight training, swimming) for at least 30 minutes 4 days a week. Think of activities done in your free time (not at work).

How much do you agree with the following:	**Strongly Disagree**						**Strongly Agree**
How much I exercise is completely up to me	1	2	3	4	5	6	7
I believe I have the resources required to exercise	1	2	3	4	5	6	7
I believe I have the opportunities to exercise	1	2	3	4	5	6	7
I believe I have all the things I need to exercise	1	2	3	4	5	6	7
I intend to exercise regularly during the next month	1	2	3	4	5	6	7
I intend to exercise at least 4 times per week during the next month	1	2	3	4	5	6	7
I intend to exercise as much as I can each week during the next month	1	2	3	4	5	6	7
I am confident that I can exercise 30 minutes 4 days a week	1	2	3	4	5	6	7
I have control over exercising 30 minutes 4 days a week	1	2	3	4	5	6	7
I am capable of exercising 30 minutes 4 days week	1	2	3	4	5	6	7

Using a 0% - 100% rating scale, rate how confident you are that you can perform each of the exercise related tasks below.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No confidence										Complete Confidence

How confident are you that you can…	
Complete moderate intensity exercise using proper technique	%
Follow directions to complete moderate intensity exercise	%
Perform all of the movements required for moderate intensity exercise	%
Exercise at a moderate intensity when you feel discomfort from the activity	%
Exercise at a moderate intensity when you lack energy	%
Include moderate intensity exercise in your daily routine	%
Consistently exercise at a moderate intensity every day of the week	%
Exercise at a moderate intensity when you don't feel well	%
Arrange your schedule to include regular moderate intensity exercise	%

Over the month, consider a typical week (7days): how many times on average do you do moderate effort exercise for more than 15 minutes during your free time (not at work)? On an average day, how many <u>minutes</u> do you do moderate effort exercise for? If you have not been doing moderate effort exercise, simply report "0".

Moderate Activity (not exhausting, light sweating) Example: brisk walking, tennis, volleyball, badminton, easy swimming, dancing, light weight training	Times per week	Average Duration

Here are some thoughts people have about life in general. Do these thoughts affect you?

	Strongly Disagree ⟶						Strongly Agree
I can do just about anything I really set my mind to	1	2	3	4	5	6	7
When I really want to do something, I usually find a way to succeed at it	1	2	3	4	5	6	7
Whether or not I am able to get what I want is in my own hands	1	2	3	4	5	6	7
What happens to me in the future mostly depends on me	1	2	3	4	5	6	7
Other people determine most of what I can and can not do	1	2	3	4	5	6	7
There is little I can do to change most of the important things in my life	1	2	3	4	5	6	7
I often feel helpless in dealing with the problems in my life	1	2	3	4	5	6	7
What happens in my life is often beyond my control	1	2	3	4	5	6	7
There are many things that interfere with what I want to do	1	2	3	4	5	6	7
I have little control over the things that happen to me	1	2	3	4	5	6	7
There is really no way I can solve all of the problems I have	1	2	3	4	5	6	7
I sometimes feel I am being pushed around in my life	1	2	3	4	5	6	7

Appendix 2-C

Post Card Reminder

Faculty of Physical Education & Recreation
University of Alberta

Survey Reminder

About one week ago we sent you a survey package in the mail. The survey was pink. If you have already completed the survey and sent it in the mail – thank you. If not, we would still like for you to participate if possible. Please complete the survey and return it to us in the self addressed stamped envelope provided.

Thanks for your time.

Terra Murray and Wendy Rodgers
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3. STUDY TWO

The role of socioeconomic status and control beliefs on frequency of exercise during and after cardiac rehabilitation.

For individuals with CVD, cardiac rehabilitation (CR) programs are an important form of secondary prevention. Cardiac rehabilitation programs are typically medically supervised and are characterized by a number of elements, including exercise training, risk factor modification, education, and psychological counseling (McGee, Hevey, & Horgan, 1999). Exercise training is considered the cornerstone of cardiac rehabilitation programs (Evon & Burns, 2004) as it confers numerous benefits including reduced mortality rates (Hamalainen, Luurila, Kallio, & Knuts, 1995) and improved psychosocial functioning (Linden, Stossel, & Maurice, 1996). However, it should be noted that a recent meta-analysis showed that similar levels of improved mortality for patients in programs with and without a structured exercise component (Clark, Hartling, Vandermeer, Lissel, & McAlister, 2007). Nonetheless, current Canadian guidelines (Canadian Association of Cardiac Rehabilitation, 2004) suggest that patients perform moderate intensity aerobic exercise between 3 and 5 days per week for approximately 20-30 minutes, although the actual exercise prescription may vary depending on individual patient factors such as fitness level. Despite the benefits of exercise to CR patients, adherence and longer term maintenance of exercise behavior remains problematic (Burke, Dunbar-Jacob, & Hill, 1997; Dorn, Naughton, Imamura, & Trevisan, 2001). Therefore, understanding factors that influence exercise behavior in CR settings is an important goal of research.

Both social and psychological factors have been found to influence *general participation* in CR programs. For example, socioeconomic status (SES) and self-efficacy

beliefs have been found to be important predictors of participation in CR (Jackson, Leclerc, Erskine & Linden, 2005). Other research has also shown that illness perceptions were related to CR attendance, so that individuals who believe that their disease is controllable were more likely to attend cardiac rehabilitation (Cooper, Lloyd, Weinman & Jackson, 1999; Petrie, Weinman, Sharpe, & Buckley, 1996). Therefore, for the current study, domain (control over health, or more specifically over a heart problem) and behavioral specific control beliefs (e.g., self-efficacy for exercise) were examined. Control over the heart problem was examined (and mastery beliefs or control over life) as it was thought that this belief might be particularly salient to patients in a CR context.

Socioeconomic Status Influences in Cardiac Rehabilitation

Previous research has consistently found that individuals with lower income and/or education are less likely to receive and participate in CR (Alter, Iron, Austin, & Naylor, 2004; Grace, Abbey, Shnek, Irvine, Franche, & Stewart, 2002; Harlan, Sandler, Lee, Lam & Mark, 1995; McHugh & Waldron, 1991). Further, income and education have also been positively associated with exercise capacity in CR patients (Fraser, Rodgers, Murray & Daub, 2007; Ruo, Rumsfeld, Pipkin, & Whooley, 2002), an important predictor of prognostic indicator of health (Meyers et al., 2002). However, little research has examined the influence of SES on exercise behavior of CR patients during and/or after rehabilitation.

Perceived Control over a Health Problem

The onset of a chronic disease may lead to feelings of uncertainty and a loss of control (Taylor, Helgeson, Reed & Skokan, 1991). Indeed, patients with heart disease have initially reported feeling a loss of independence, greater vulnerability and lower

self-confidence (Clark, Barbour, White & MacIntyre, 2004). Some individuals may strive to gain a sense of control over their health, believing that their disease is manageable or that future cardiac events are avoidable (Helgeson, 1992). There may be an advantage then for patients to have a sense of control, because they can perform actions (e.g., being more physically active) to enhance their health.

People who perceive control over their health problem have better physical and psychological functioning across a variety of chronic diseases, including Type 1 diabetes (Helgeson & Franzen, 1998), cancer (Helgeson, Snyder & Seltman, 2004; Tomich & Hegelson, 2002) and CVD (Hegelson, 1992; 1999; Taylor et al., 1991). Longitudinal research has demonstrated that perceptions of control over their heart problem influenced future physical functioning in CR patients. Specifically, researchers found that increases in perceived control predicted decreased anxiety and depression at a 2 month follow up, which was related to better physical functioning at 8 months (Michie, O'Conner, Bath, Giles & Earll, 2005).

However, inconsistent findings have been reported. For example, Carver et al. (2000) found no significant association between perceptions of control over breast cancer and psychological distress in women. Similarly, perceptions of control were not related to and psychological adjustment in individuals with heart disease (Fowers, 1994). Moreover, other research has found that control beliefs may be detrimental. Researchers examining control beliefs around disease symptoms have found that patients with arthritis who perceived higher control were more likely to experience greater mood disturbance and poorer adjustment, particularly in patients with high disease severity (Affleck, Tennen, Pfeiffer & Fifield, 1987).

Perceptions of control are also thought to have implications for adherence to medical regimens in patients with a chronic disease (Taylor et al. 1991; Helgeson, 1992). Patient's perceptions of control over their heart disease were positively associated with post-operative changes in health behavior, including exercise (Gump, Matthews, Scheier, Schultz, Bridges & Magovern, 2001). In patients awaiting coronary artery bypass surgery, older patients were more likely than younger patients to believe that they had no control over their heart disease, and that the disease would be "gone" after surgery (Gump et al.).

Overall, the majority of the research seems to show that perceptions of control over a disease are beneficial. Perceived control over a disease has been associated with improved psychological and physical functioning (Hegelson, 1992; Helgeson & Franzen, 1998; Helgeson et al., 2004; Michie et al., 2005; Moser & Dracup, 1995; Taylor et al., 1991; Tomich & Hegelson) and adherence health promoting behaviors (Taylor et al.; Helgeson, 2002), including exercise in heart patients (Gump et al., 2001).

Perceptions of Control over Exercise Behavior

Similar to health and health behavior research in healthy populations, behavioral specific perceptions of control, specifically self-efficacy beliefs, have been examined in CR settings. Self-efficacy beliefs reflect an indivdiual's belief in his or her own capabilities to "organize and execute the course of action required to produce given attainments" (Bandura, 1997, p. 3). Bandura argues that self-efficacy beliefs play a critical role in whether individuals pursue rehabilitative activities.

Self-efficacy has been found to be a robust predictor of participation in CR programs in general (Jackson et al., 2005), with more efficacious individuals more likely

to participate in CR (Grace et al., 2002; King, Humen, Smith, Phan, & Koon, 2001; McHugh & Waldron, 1991). Self-efficacy has also been found to be positively associated with exercise behavior in CR patients. For example, more efficacious individuals were more likely to intend to be more active (Sniehotta, Scholz & Schwarzer, 2005) and engage in more physical activity behavior during (Blanchard, Rodgers, Courneya, Daub and Knapik, 2002a; Evon & Burns, 2004; Ewart, Taylor, Reese, & DeBusk, 1983; Guillot, Kilpatrick, Hebert & Hollander, 2004) and after (Bock et al., 1997; Carlson, Norman, Feltz, Franklin, Johnson & Locke, 2001; Sniehotta et al.) rehabilitation.

However, other research has found no significant relationship between self-efficacy and exercise behavior during (Bray & Cowan, 2004; Jeng & Braun, 1997) or after (Blanchard et al., 2007) CR. Self-efficacy assessed prior to beginning rehabilitation was not be related to exercise behavior during 12 weeks of rehabilitation among CR patients (Jeng & Braun). Further, while Blanchard et al. found that (barrier) self-efficacy was related to exercise during rehabilitation, it was not a significant predictor of exercise after (6-10 weeks post rehabilitation) CR.

Recent research suggests that different types of self-efficacy may be important in determining exercise behavior in patients during CR. Specifically, two types of self-efficacy that are commonly found in the literature are task self-efficacy and coping self-efficacy, also referred to as self-regulatory efficacy (Bandura, 1997) or barrier efficacy (Blanchard et al., 2002a; 2007). Task self-efficacy refers to one's confidence to perform elemental aspects of the behavior itself, whereas coping self-efficacy refers to one's confidence to perform the behavior under challenging conditions. In general, research that has examined different types of self-efficacy has found coping or self-regulatory

efficacy to be key predictor of exercise behavior in patients during CR, and task self-efficacy seems to be less important (Blanchard et al., 2007; Maddison & Prapavessis; 2004; Woodgate, Brawley & Weston, 2005). For example, Maddison and Prapavessis found that task self-efficacy was not related exercise attendance in a CR program. However, barrier self-efficacy was related to attendance behavior at the beginning (weeks 1-6) and at the end (weeks 13-18) of the program, but not in the middle (weeks 7-12) of the program (Maddison & Prapavessis).

A few studies have also begun to examine the role of PBC on exercise intentions and behavior in CR. In examining constructs from the theory of planned behavior in a cardiac population, researchers have found that PBC (along with attitudes) was a significantly associated with exercise intentions (Godin, Valois, Jobin and Ross, 1991) and behavior during and after CR (Blanchard, Courneya, Rodgers, Daub & Knapik, 2002b).

In summary, most research seems to support the notion that control beliefs are beneficial in terms of well being and promoting healthy behaviors. However, there are disparate findings. For example, whereas some research has demonstrated the positive influence of control beliefs, some has found no statistical association, and other research has demonstrated the detrimental effects of control beliefs on behaviour among individuals with a chronic disease. Differences in findings may be the result of differences in how perceptions of control have been conceptualized and operationalized in chronic disease research, or in the differences in the diseases and populations studied.

In studies reviewed here, control beliefs have been conceptualized and operationalized a number of different ways, ranging from control over a disease, self-

efficacy beliefs and PBC. Thus, depending on the study, control beliefs are either directed towards the disease (i.e., the degree to which patients believe they can control or influence aspects of their disease) or the behavior (i.e., the degree to which patients believe that they are confident or have control over physical activity behavior). Different kinds of control, for example perceptions of control over a heart problem and self-efficacy beliefs, may be related to different outcomes, including behavioral (e.g., exercise) outcomes during and after the rehabilitation period.

The majority of research examining psychological correlates of exercise behavior in CR has adopted self-efficacy as a theoretical construct (Blanchard et al., 2002a). Bandura (1997) argues that self-efficacy beliefs play an important role in determining whether people engage in rehabilitative behaviors, such as exercise. However, results of research studies in CR settings have been inconsistent. Perhaps self-efficacy is simply an inconsistent or inadequate predictor of exercise in CR patients. However, studies that reported null findings also reported measurement problems with self-efficacy. For example, Bray and Cowan (2004) measured what might be considered task self-efficacy for walking (e.g., "how confident are you that you can walk briskly"), and used this to predict exercise during CR. However, it is possible that task self-efficacy alone is not an ideal predictor of exercise during CR, other aspects of the behavior as reflected by other types of self efficacy (coping self-efficacy) may be more important in terms of predicting exercise (Blanchard et al., 2007; Maddison & Prapavessis, 2004). Moreover, it is possible that other control beliefs, such as control over the illness, play an important role in predicting exercise behavior in CR settings. A question arises as to which kind of control

contributes to exercise behavior during the rehabilitation period, and after the rehabilitation period.

The influence of control beliefs on behavior may also vary among different chronic diseases, or even within different subgroups of patients with the same disease. For example, some previous research has found that control beliefs may not be adaptive under certain conditions, such as when disease severity is high (Affleck et al., 1987). However, it may also be the case the control beliefs are not adaptive when the patient has lower SES. Individuals with low SES (i.e., income, education) typically have fewer resources and additionally may benefit less from resource mobilization during stressful times, and as such may be more likely to suffer negative consequences (Gallo, Bogart, Vranceanu, & Matthews, 2005). Under such circumstances, it may be that the level of actual control the patient has is low, and therefore a strong belief in personal control in a situation where there are actually few opportunities for control may be problematic. Previous research has found that individuals with low SES are less likely to participate in CR, but what about lower SES individuals who do participate in CR? It may be that individuals with low SES attending a CR program are less likely to benefit from rehabilitation (cf., Fraser et al., 2007). For example, CR patients with lower SES may perceive that they have less control over their heart problem and over their exercise, and may be more likely to exercise less during and after rehabilitation than patients with higher SES.

Understanding the extent to which SES and different control beliefs are related to exercise behavior during and after rehabilitation may have potentially important implications for CR programs. For example, if a patient believes that there is little he/she

can do to control their heart problem, and this is related to poorer exercise during (or after) the program, then program staff may need to focus their efforts on patient's beliefs about their illness. However, if patients lack confidence for exercising, and this is related to less exercise during the program, the program staff may need to focus on efficacy beliefs.

Therefore, the purpose of this study was to examine the association between SES and control beliefs (control over their heart problem and self-efficacy beliefs) on exercise behavior during rehabilitation and one month after rehabilitation in patients attending a CR program. It was hypothesized that SES would be positively associated with control beliefs and with exercise before and after CR. It was also hypothesized that control beliefs would be positively associated with exercise during after CR. Which indicators of SES and which control beliefs would emerge as significant statistical predictors was exploratory.

Method

Participants

In order to examine these relationships, 19 women (*M* age = 67.84, *SD* = 9.05) and 110 men (*M* age = 59.05, *SD* = 10.50) were recruited from the Northern Alberta Cardiac Rehabilitation Program at the Glenrose Hospital. Typically cardiac rehabilitation programs have lower ratios of women to men (women generally make up around 20% of the patients; Blackburn et al., 2000; King et al., 2001; Missick, 2001). The cardiac rehabilitation program is tailored to each individual patient's needs, and thus the overall length of the program can vary from patient to patient. Further, during the data collection process, the program underwent several changes, including the length of time of the

rehabilitation period which varied anywhere from one to eight weeks, depending on programming decisions at the time as well as the needs of the patient. Although the duration of the program varied during the course of the study, it is important to note that for any patient the length of the program can be adjusted (shortened or lengthened) based on the progress and needs of the patient as determined by both the patients and CR staff. Patients also may attend education classes (stress reduction, nutrition etc.) during the rehabilitation period, although this is optional.

Procedure

Once patients were referred to CR, they were mailed the questionnaire package with other orientation material by program staff. This material is typically mailed to the patients before they attend their orientation session at the Glenrose Hospital. A researcher was also present at each orientation session and administered surveys to any patients who may have not received one in the mail (or may have lost it). The survey package included a brief cover letter, an information letter (see Appendix 3-A), a consent form and the survey itself (see Appendix 3-B). Participants were instructed to bring the completed survey and consent form to the orientation session. If they had not completed it yet, they were asked to complete it within the following day, and return it at their next appointment. Typically a few days after the orientation session participants complete an exercise tolerance test, and then begin their rehabilitation program.

Figure 3-1 shows the flow of participants through the study and Figure 3-2 shows the study timeline and assessments. Participants completed a baseline questionnaire assessing control beliefs, SES and exercise behavior prior to or immediately following orientation (Time 1). Participants then complete between 1 and 8 weeks of rehabilitation.

For the exercise portion of rehabilitation, participants generally are asked to complete two sessions of moderate intensity exercise at the NACRP unit, and at least another 2 to 3 sessions at home each week, for a total of 4 – 5 days a week of moderate intensity exercise. Immediately following their rehabilitation period, participants were sent a follow up survey (see Appendix 3-C) in the mail (assessing control beliefs and exercise behavior) with a self addressed postage paid return envelope (Time 2). Exercise behavior (see Appendix 3-D) was again assessed one month after completing rehabilitation (Time 3). A one month post CR follow up was chosen for logistical reasons (i.e., to keep the total time period for data collection to about one year), and because it was thought that any additional influences of CR on study variables (e.g., control over the heart problem) should be detected in that time. All participants received reminder phone calls prompting them to complete and return the Time 2 and 3 surveys.

Measures

Demographic information. Age, sex (0 = female, 1 = male), height, weight, marital status and were collected from medical charts.

Household Income. Income was measured according to total annual household income and household size. The household income measure asked participants, "Which of the following is your best guess of the total income, before taxes and deductions, of all household members from all sources in the past year." This question was followed by 13 income response categories, ranging from *no income* to *$150 000 or more*. This method is similar to the most recent draft of the National Population Health Survey in Canada, and similar measures have been used in previous health research in Canada (Bailis et al., 2001; Gauvin, 2003; Humphries & van Doorslaer, 2000; Kosteniuk & Dickinson, 2003).

To assess household size participants were asked "Including yourself, how many people live at your household?" To adjust for the influence of household size on household income, the midpoint of each income category range was divided by the square root of the number of people living in the household (Humphries & van Doorslaer, 2000) to correct for "differences in household size while taking into account economies of scale in household production" (p.666).

Education. Educational attainment was collected from medical charts and was categorized as "less than high school", "high school", "post secondary." A higher number reflects higher educational attainment.

Occupation. Due to the large number of patients who were retired or unemployed (n = 54), occupation was indicated by employment status (and not job category), which was collected from the medical charts and assessed by the following categories: employed (full time or part time) or not presently employed (e.g., retired, home maker, unemployed).

Subjective Social Status. Participants were shown a drawing of a 10 rung ladder and asked to place an 'X' on the rung that best described where they stood on the ladder with respect to others in society (Adler, Epel, Castellazzo, & Ickovics, 2000). Previous research has shown that the scale has demonstrated adequate test retest reliability (Operario, Adler & Williams, 2004), and it has been moderately correlated to traditional measures of SES, including education, income and occupation (Singh-Manoux, Adler & Marmot, 2003), and predicted self-rated health and psychological well-being (Adler et al.; Hu, Adler, Goldman, Weinstein & Seeman, 2005; Singh-Manoux et al.). Further, subjective social appears to capture aspects of SES beyond traditional, objective

indicators if SES (Ghaed & Gallo, 2007). A higher score on the scale indicates higher perceived social status.

Self-efficacy for exercise. Exercise self-efficacy was assessed with 9 items (Rodgers, Wilson, Hall, Fraser & Murray, in press; Rodgers & Sullivan, 2001) using a 100% confidence scale ranging from 0% (no confidence) to 100% (complete confidence) according to the recommendations of Bandura (1986). Following the stem "How confident are you that you can", three items were used to assess task (e.g., "complete the exercise using proper technique") coping (e.g., "exercise when you lack energy"), and scheduling SE (e.g., "arrange your schedule to include regular exercise"). The mean of the three items comprising each scale was used to obtain overall task, coping and scheduling self-efficacy scores (Rodgers et al.; Rodgers & Sullivan). This scale has demonstrated adequate convergent and discriminant validity (Rodgers et al.). Cronbach's alphas (Cronbach, 1951) ranged from .92 to .92 for task, .87 to .92 for coping and .95 to .96 for scheduling SE over the course of the study indicating acceptable internal consistency (Nunnally & Bernstein, 1994).

Perceptions of control over the heart problem. Perceived control over their disease (heart problem) was measured with four items used in previous studies with chronic disease populations (Helgeson, 1992; Helgeson & Franzen, 1998; Helgeson et al., 2004). The items were adapted so they accurately reflected the current patient population (i.e., cardiac patients). Patients were instructed, "Some people believe that they have control over the course of their heart problem. This can be due to a positive attitude, dietary or exercise changes or something else." They were then asked to rate the extent to which they could control: (1) "the future course of your heart problem – that is, how

you will feel physically in the future because of your heart problem," (2) "the type of medical care you receive", (3) "your emotions and feelings about your heart problem", and (4) "your day to day symptoms, such as fatigue, pain or other symptoms". Responses were made on a 5-point Likert type scale ranging from "none" to "a lot" and the mean of all items was calculated to produce an overall index of perceived control over the illness (Helgeson & Franzen). Cronbach's alphas (Cronbach, 1951) for this scale was $\alpha = .74$ at Time 1 and $\alpha = .71$ at Time 2, indicating ting acceptable internal consistency (Nunnally & Bernstein, 1994).

Perceived behavioral control. PBC for exercise behavior was assessed with 7 items on a 7 point rating scale. Four of the items (e.g., "how confident are you that you can exercise regularly?") represented more typical PBC items (Armitage, 2005). The remaining three items (e.g., "I believe I have the resources required to exercise") were used to measure beliefs around resources and opportunities (Ajzen & Driver, 1992; Motl et al., 2000). The mean of the items was used to derive an overall PBC score, with a higher score indicating stronger behavioral control beliefs. Internal consistency (Cronbach, 1951) for this scale was $\alpha = .89$ at time 1 and $\alpha = .91$ at Time 2.

Exercise behavior. Self report mild and moderate intensity leisure time exercise behavior was assessed with a modified version of the Leisure Time Exercise Questionnaire (LTEQ; Godin & Shepard, 1985). Participants were instructed to consider how many times per week over the past one month they engaged in mild and moderate exercise behavior. Strenuous effort exercise was not assessed as patients in this cardiac rehabilitation program are not given exercise guidelines for vigorous effort exercise. For the purposes of this study, only moderate effort exercise was used in analysis as the

majority of patients are given exercise guidelines that focus on moderate effort exercise behavior. Previous research has found that the LTEQ compares favorably to other self-report measures of physical activity on a variety of criteria including test-retest reliability, objective activity monitoring and fitness (Jacobs, Ainsworth, Hartman & Leon, 1993).

Exercise intentions. Intentions to exercise were assessed with 3 items on a 7 point scale with two items ranging from, (1) strongly disagree to (7) strongly agree, and one item using verbal descriptors ranging from (1) attend some scheduled classes/not at all to (7) attend every exercise class/every day. At time 1, the items reflected intentions to exercise during rehabilitation, and at Time 2 the items reflected intentions to perform moderate effort exercise in general. Similar items have been used previously in CR studies (Blanchard et al. 2002b), and in the exercise literature in general (Conner, Rodgers & Murray, in press). The mean of the three items were computed to produce an overall behavioral intention measure, with a higher score reflecting stronger intentions. Internal consistency (Cronbach, 1951) for this scale was $\alpha = .68$ at Time 1 and $\alpha = .81$ at Time 2.

Analyses

All analyses were conducted with the Statistical Package for the Social Sciences (SPSS) version 15. In order to examine the relationship among SES, control beliefs and exercise behavior, zero order correlations were calculated and hierarchical regression analyses were used, with the Time 1 variables (i.e., control over illness, self-efficacy and intentions) used to predict frequency of exercise behavior during the rehabilitation period (i.e., Time 2 behavior) and the Time 2 variables (i.e., control over illness, self-efficacy and intentions) used to predict frequency of exercise behavior after the rehabilitation

period (i.e., Time 3 behavior). The independent variables for each set of analysis were income, education, subjective social status, control over the heart problem, self-efficacy beliefs and PBC. Each analyses controlled for the following demographic and medical factors: age, gender, BMI, exercise capacity before CR (in METS), and number of health problems.

Results

Data Screening and Preparation

Data were first screened for both missing and unusual values (those values outside the possible response options) by examining the means, ranges and frequencies of responses to each item (Tabachnik & Fidell, 2001). Missing and unusual values were checked with original data and replaced with the appropriate value or confirmed as missing.

For SES indicators, the rate of missing data varied. For level of education, there were no missing data. Data were missing from 15.5% (n = 20) of the sample for income and 13% of the sample (n = 17) did not respond to the question assessing subjective social status. As this is a large proportion of the sample, and because both income and subjective social status were key variables in this study, these participants were eliminated from the analyses using these variables.

Some participants did not respond to all of the items for BI, PBC, self-efficacy and control over illness scales. The rate of the missing data ranged from 2 – 10 missing values per item assessed at Time 1. For example, there were 2 responses missing for control over illness item 1, and 10 responses were missing from self-efficacy item 4. For the participants (n = 107) who returned the Time 2 survey, the rate of missing data ranged

from 1 – 3 missing values per item. For example, there was 1 response missing for control over the illness item 4 and 3 responses missing for self-efficacy item 8. Because the number of missing values was generally low, missing data for each item was replaced with the mean of the participant's response for the other items of the given subscale where possible (Tabachnik & Fidell, 2001).

Some participants did not respond to any items for a particular scale, and as such mean responses could not be calculated, and these participants were excluded from analyses. Specifically at Time 1, for control over the illness, PBC and behavioral intentions, there were 2 participants who did not respond to each of the scales. For task self-efficacy, 4 participants did not respond to the scale, and for both coping and scheduling self-efficacy, 5 participants did not respond to the scale. PBC and behavioral intentions, there were 5 participants who did not respond to any items. For self-efficacy, there were 8 participants who did not respond to the scale. At Time 1, one participant did not respond to the scale assessing mild and moderate physical exercise. For the participants ($n = 107$) who returned the Time 2 survey, there were no items missing for an entire scale.

Data were also screened for outliers. Outliers are extreme values or data points (Tabachnik & Fidell, 2001; Osborne & Overbay, 2004), which fall far outside the norm for a variable or population, for example a datum point that is three or more standard deviations from the mean (Osborne & Overbay). Outliers were initially examined using z-scores, histograms, and box plots (Osborne & Overbay; Tabachnik & Fiddel). Potential outliers were examined with the raw data to determine possible data entry errors, which were subsequently corrected. The skewness and kurtosis of the exercise data was also

examined (see Table 3-.2). Follow up regression analyses was used to examine impact of any remaining outliers. Specifically, Cook's D and the leverage values were examined. Results suggested that the impact of the potential outliers was minimal as all Cook's D values were below 1 and the leverage values were low (Kleinbaum, Kupper & Muller, 1988). Thus, although some of the data were somewhat skewed and flat (negative kurtosis), this likely had little impact in the analysis (Tabachnik & Fidell, 2008).

Descriptive Statistics

Complete behavioral follow up was available for $N = 107$ participants (see Figure 3-2). No significant differences existed between participants who completed and did not complete the Time 1 and Time 3 survey in terms of income (F (1, 107) = .26, p = .613, partial η^2 = .002), education (F (1, 127) = .00, p = .968, partial η^2 = .000), employment status ($\chi^2(1, N = 129) = .36, p = .547$). subjective social status (F (1, 110) = .28, p = .599, partial η^2 = .003), BMI (F (1, 127) = 3.14, p = .079, partial η^2 = .024), mild exercise times per week (F (1, 126) = .01, p = .909, partial η^2 = .000), moderate exercise times per week (F (1, 126) = .01, p = .946, partial η^2 = .000), control over the heart problem (F (1, 125) = .00, p = .983, partial η^2 = .000), task self-efficacy (F (1, 123) = .17, p = .980, partial η^2 = .001) , coping self-efficacy (F (1, 121) = 2.12, p = .148, partial η^2 = .017), scheduling self-efficacy (F (1, 121) = .07, p = .786, partial η^2 = .001), PBC (F (1, 125) = 1.05, p = .307, partial η^2 = .008) and behavioral intentions (F (1, 125) = 1.36, p = .246, partial η^2 = .011) measured at Time 1. However, there were significant differences in terms of age (F (1, 127) = 4.40, p = .038, partial η^2 = .033) and sex ($\chi^2(1, N = 129) = 4.58, p < .05$). Specifically, participants who did not complete the Time 3 survey were younger (M age = 55.32 compared to 60.32) and were men.

The demographic profile of participants, including comorbidity and admitting diagnosis are presented in Table 3-1 and the descriptive statistics of the study variables are presented in Table 3-2. The average age of participants was 59 years, and most participants were married (79.8%). The majority of the sample had either high school diploma (39.5%) or some post secondary education (52.7%), and were either employed full time (37.2%), or were retired (34.1%). The mean annual household income (adjusted for household size) was approximately $45 000 per year. The most common admitting diagnosis prior to rehabilitation was myocardial infarction (55.0%), followed by bypass surgery (28.7%).

Table 3-3 shows correlations among indicators of SES with control beliefs, intentions and behavior at each time point. For the indicators of SES, employment status showed the weakest relation overall to the study variables. While being employed was related to task self-efficacy, coping self efficacy and PBC assessed at the beginning of the rehabilitation period (i.e., Time 1), it was not related to any of the other cognitions at Time 1 or any variables assessed at Time 2. No indicators of SES were related to behavior before or during the rehabilitation period (at Time 1 or Time 2). However, both income and social status were related to exercise behavior after rehabilitation (at Time 3).

Table 3-4 shows the associations among the control beliefs, intentions and behavior at each time point. At each time, all control beliefs were positively associated with each other. At Time 1, the strongest associations were between the self-efficacy beliefs, and PBC (notably PBC and task self-efficacy). All exercise specific control beliefs were positively related to intentions, with PBC and intentions sharing the strongest correlation coefficient and coping self-efficacy and intentions sharing the

weakest correlation coefficient. Perceived control over the heart problem was not significantly related to intentions to exercise during CR. All control beliefs, except PBC, and were positively associated with exercise behavior during rehabilitation. Task and scheduling self-efficacy assessed at the beginning of rehabilitation shared the strongest association with exercise behavior during rehabilitation, followed closely by Time 1 coping self-efficacy. Interestingly, intentions to exercise during rehabilitation (i.e., at Time 1) were not significantly related to exercise behavior during rehabilitation.

At Time 2, all control beliefs are again positively associated with each other (see Table 3-4). The strongest associations were again among the self-efficacy beliefs, and between the efficacy beliefs and PBC (notably PBC and scheduling self-efficacy). Task self-efficacy, scheduling self-efficacy and PBC were all significantly related to exercise behavior after CR, and in a similar magnitude. Perceived control over the heart problem and coping self-efficacy were not significantly related to behavior after CR. Intentions to exercise after CR were positively associated with all control beliefs, with the strongest correlation coefficient between scheduling self-efficacy and intentions (followed closely by PBC with intentions) and the weakest relation between perceived control over the heart problem and intentions. At this time point, intentions to exercise after CR and behavior after CR were significantly associated with each other.

Regression Analyses Predicting Frequency of Exercise During Rehabilitation

The contribution of SES (i.e., income, education, subjective social status) as well as the Time 1 control variables (control over heart problem, task, coping and scheduling self efficacy, PBC) on frequency of exercise during the rehabilitation period (i.e., Time 2 exercise) was examined. The following medical and demographic variables were

controlled for in the regression analyses on the first step: age, gender, BMI, exercise capacity (in METS) and number of health problems. Further, because behavioral intentions measured at Time 1 was not significantly associated with any of the study variables (except subjective social status), it was excluded from the regression analysis[1].

The independent variables were also examined for evidence of multicollinearity. Multicollinearity refers to moderate to high intercorrelations between independent or predictor variables (Stevens, 2002). It can be of concern in regression analysis as it may limit the size of *R*, makes it difficult to determine the relative importance of a given predictor variable, and it can increase the variances of the regression coefficients which may cause unstable regression equations (Stevens). As the some of the variables shared moderate to high correlations, collinearity diagnostics were examined. Specifically, the variance inflation factor (VIF) was examined (Stevens), as well as the condition index and variance proportions (Tabachnick & Fidell, 2007). A VIF value of greater than 10 (Stevens), and a condition index greater than 30 together with variance proportions greater than .50 on at least two variables (Tabachnick & Fidell) all indicate problems with multicollinearity. None of these criteria were met, suggesting that multicollinearity was likely not a significant problem.

Results of the regression predicting exercise behavior during the rehabilitation period are presented in Table 3-5. As can be seen in the table, the demographic and medical factors entered in step 1 explained approximately 15% of the variance in exercise during CR, with exercise capacity having the only significant beta coefficient. None of the indicators of SES made a significant contribution to the regression equation on step 2. However, patients' perception of control over their heart problem, entered on step three,

did make a significant contribution to the regression equation, explaining an additional 4% of the variance in behavior. The self-efficacy variables were entered on step 4, and PBC was entered on step 5. None of the self-efficacy variables or PBC were significant. After the addition of the self-efficacy variables, exercise capacity and patients' control over their heart problem were no longer significant[2].

Regression Analyses Predicting Frequency of Exercise After Rehabilitation

The contribution of SES as well as the Time 2 control variables on frequency of exercise one month *after* the rehabilitation period (i.e., Time 3 exercise) was examined. Similar to the first regression, the following demographic and medical factors were included on the first step of the analyses: age, gender, BMI, exercise capacity and number of health problems. The independent variables were once again examined for evidence of multicollinearity. There was some evidence of multicollinearity for behavioral intentions, which had a condition index of 56 and variance proportion greater than .50 with scheduling self-efficacy. Therefore, this variable was eliminated from the regression analysis.[3]

Results of the regression predicting exercise behavior after the rehabilitation period are presented in Table 3-6. As can be seen in the table, the overall model on step 1 (demographic and medical factors) was not significant, although age did have a *p* value of .04. Similarly, none of the indicators of SES made a significant contribution to the regression equation on step 2. Patients' perception of control over their heart problem was entered on step 3 and was not a significant predictor of behavior. On step 4 the self-efficacy for exercise variables were added. Task self-efficacy was not a significant predictor of exercise behavior, but coping and scheduling self-efficacy both made a

significant contribution, explaining about 18% of the variance in post rehabilitation exercise behavior. However, coping self-efficacy showed a negative beta coefficient, yet n the zero order correlations, coping self-efficacy was positively related to post rehabilitation exercise behavior (r = .16), suggesting a potential suppressor effect. PBC was added on step 4, and was not significant.[4]

Discussion

The purpose of the current study was to examine the association between SES, control beliefs and exercise behavior during and one month after CR in a sample of patients. It was hypothesized that there would be positive associations among SES, control beliefs and behavior during and after rehabilitation. However, examining the exact predictors of behavior during and after rehabilitation was exploratory.

Associations Among SES, Control Beliefs and Frequency of Exercise

One objective of the current study was to examine the association between SES and frequency of exercise during and after rehabilitation, and it was hypothesized that SES would be positively related to exercise frequency during and after CR. Contrary to the hypothesis, no indicator of SES (i.e., income, education, employment status, social status) was related to exercise frequency during rehabilitation. However, patients with more income and higher social status were engaging in more frequent exercise one month after rehabilitation. Perhaps SES was not a significant correlate of exercise *during* rehabilitation because the program creates a 'level playing field', as all patients who attend CR are provided with the same place to exercise (at least some of the time), the same educational material, and have the support of staff and other patients. That is, patients who attend CR are given similar resources and opportunities to be active during

rehabilitation, so perhaps the program serves to mitigate some of the effects of SES on behavior. Once patients finish rehabilitation they are to continue with exercise on their own. For example, patients need to find a place to exercise (all of the time), and they no longer have the same level of contact with the rehabilitation program staff. Further, patients may return to work if they were employed, or attend to other life tasks that may have been put on hold during their rehabilitation. Thus, resources and opportunities for exercise become more limited after CR, and exercise becomes the sole responsibility of the patient. Having adequate resources (e.g., money) was important for continued exercise participation after rehabilitation. The positive association between SES (i.e., income and social status) and exercise frequency after CR was consistent with previous research which has found higher levels of SES (including subjective social status) were associated with greater amounts of physical activity and exercise in asymptomatic populations (Clark, 1995; Cohen, Kaplan & Salonen, 1999; Garcia Bengoechea & Spence, 2002; Garcia Bengoechea, Spence, & Fraser, 2005; Gauvin, 2003; Ghaed & Gallo, 2007; Iribarren, Leupker, McGovern, Arnett & Blackburn, 1997; US Department of Health and Human Services, 1996) and symptomatic populations (Barrett, Plonikoff, Courneya & Raine, 2007; Hays & Clark, 1999; Plonikoff et al., 2006).

A second purpose of this study was to examine the association between SES and control beliefs. As expected, SES was positively associated with control beliefs assessed before rehabilitation (i.e., Time 1) and after rehabilitation (i.e., Time 2). In particular, subjective social status appears to be a key SES correlate, as it showed the strongest association (of the SES variables) with each control belief. Further, task and coping self-efficacy, along with PBC assessed before CR were positively associated with each

indicator of SES. Task and coping self-efficacy assessed after rehabilitation continued to show important associations with SES. These findings are consistent with previous research showing positive associations between various indicators of SES (income, education) and self-efficacy beliefs in older adults (Clark et al., 1995) and Albertans (Garcia Bengoechea & Spence, 2002). Findings of this study extend previous research by examining these relations in a CR patient sample, and including an additional, less traditional, measure of SES, subjective social status. Further, although few studies have examined the association of SES on PBC (Hagger et al., 2002), this study shows that SES was positively related to PBC, although the magnitude of the relationship between SES and PBC was somewhat smaller than the relationship between SES and self-efficacy.

Exercise Frequency During Cardiac Rehabilitation

Before beginning their rehabilitation program, patients who reported that they had control over their heart problem, and who were confident in their ability to perform, schedule and cope with the demands of exercise, and who perceived that they had control over their exercise were more likely to report exercising more days per week during rehabilitation. This finding is consistent with the hypotheses and some of the previous exercise research in CR (Gump et al., 2001; Blanchard et al., 2002a; 2002b; Ewart et al., 1983; Guillot et al., 2004). In this study, the strongest association was among the self-efficacy beliefs and exercise, and the weakest association was between PBC and exercise. Unlike the results from some studies (Bray & Cowan, 2004; Jeng & Braun, 1997; Maddison & Prapavessis, 2004), the results of this study show that self-efficacy, including task self-efficacy, was an important correlate of exercise during CR.

In terms of exercise intentions, it was somewhat surprising that no significant association existed between patients' intentions to exercise frequency during rehabilitation and self-reported exercise behavior during rehabilitation. This finding is in contrast to other research showing intentions to be a key predictor of exercise (Blanchard et al., 2002b). In this study, at Time 1 intentions were quite high, with the majority of patients' reporting strong intentions to exercise over the course of their rehabilitation program. Given that participating in CR is voluntary, patients who attended rehabilitation were probably highly motivated to exercise which resulted in higher intention scores. The high behavioral intention scores observed showed a restricted range, and this may have limited prediction of that variable.

Results from the regression analysis predicting exercise frequency during rehabilitation showed that patients with higher exercise capacity and stronger perceptions of control over their heart problem were the key predictors of exercise behavior during the rehabilitation period, although this effect was attenuated once other control beliefs (self-efficacy and PBC) were entered into the model. SES was not a significant predictor of behavior during rehabilitation. Additionally, neither self-efficacy beliefs nor PBC were significant predictors of exercise behavior during rehabilitation.

It was somewhat unexpected that self-efficacy beliefs and PBC (i.e., steps 4 and 5 of the regression predicting behavior during rehabilitation, see Table 3-5) assessed at Time 1 were not significant in the regression model examining exercise during CR, given that all these beliefs were significantly correlated to behavior during CR. This may be related to problems associated with using change in variance (i.e., ΔR^2) in hierarchical regression analyses (Trafimow, 2004). Trafimow has been critical of the change in R^2

approach as the meaning of change in R^2 depends on the initial size of the correlation (i.e., the size of the R on step 1). With a large R on step 1, there may be a smaller degree of change on subsequent steps. Further, he argues that weaknesses in reliability and validity of the measures can contribute to an underestimation of the correlation between the variables and as such can inflate the variance accounted for by subsequent variables (although the second step estimates still may be underestimated). In the current study, it could be that there was an artificial increase in R^2 on the subsequent steps (i.e., steps 1 through 3, Table 3-5). However, the correlations and subset analyses (see Appendix 3-E) suggest that the self-efficacy variables are important correlates of exercise during CR.

Additionally, the scores for PBC at Time 1 were quite high, with the majority of patients' reporting high behavioral control beliefs for exercise during rehabilitation. The high PBC scores at Time 1 showed a restricted range, and this may have limited prediction of that variable. It may not be surprising that PBC scores were high, given that patients are essentially provided with the things they need to exercise during rehabilitation (e.g., a safe place to exercise in, an individual exercise program, support of staff). Further, Blanchard et al. (2002b) found that PBC was not a significant predictor of exercise during CR, although this was after intentions were included in the model.

Task, coping and scheduling self-efficacy beliefs (measured at Time 1) were positively correlated with behavior during rehabilitation, and each in a similar magnitude. However, in the regression analyses, none of these self-efficacy beliefs emerged as a significant predictor of exercise behavior during the rehabilitation period. There have been inconsistent results in the previous literature regarding self-efficacy and exercise in CR patients. For example, some studies have found task self-efficacy to be a poor

predictor of exercise during rehabilitation (Bray & Cowan, 2004; Jeng & Braun, 1997; Maddison & Prapavessis, 2004). However, coping self-efficacy beliefs have generally been shown to predict exercise during rehabilitation (Blanchard et al., 2002a; 2002b; 2007; Maddison & Prapavessis; Woodgate et al., 2005). Based on the results of the current study, one might conclude that self-efficacy beliefs are not an important predictor of exercise behavior during CR. However, it is important to note that all of the exercise specific control beliefs had significant bivariate correlations with exercise behavior during CR, but they did not emerge significant when combined with one another in the regression model.

In the current study, all control beliefs were correlated with one another, and while multicollinearity did not appear to be a problem, the shared associations among the variables may have obfuscated the results in the regression analysis (Kleinbaum et al., 1988). Further, the null result regarding prediction of exercise by self-efficacy beliefs may also have been partly attributable to the timing of the measurement of self-efficacy beliefs, and as there was a lack of correspondence between the self-efficacy measure that represented confidence around aspects of exercise *during* the CR but was assessed *prior* to the CR program. That is, participants may have been uncertain as to what their confidence was for exercise during CR because they had not started their program yet, and were uncertain of what exercises they would be doing, how challenging they would be and so on. It may be advantageous in future research to assess efficacy beliefs during the first week of CR, after patients have had some experience with the exercise, to get better representation of efficacy beliefs.

Control beliefs that were specific to exercise behavior (self-efficacy and PBC) did not significantly predict exercise behavior during rehabilitation, but patients control over their heart problem was, at least initially, a significant predictor of behavior, as was exercise capacity. Before beginning their rehabilitation program, patients who had better exercise capacity and who believed that they had control over their heart problem were more likely to exercise during rehabilitation. Exercise capacity has been associated with activity status, prognosis and mortality such that better exercise capacity is associated with more physical activity, and lower exercise capacity has been associated with poorer prognosis and higher mortality (Meyers et al., 2002). Thus, it is not surprising that CR patients in this studies who had better exercise capacity exercised more during rehabilitation. Additionally, other previous research that has also found patients' perception of control over their heart problem was positively associated with exercise behavior following their cardiac event (Gump et al., 2001). In cardiac patients, perhaps exercise specific control beliefs are not as salient as control beliefs around their heart problem, especially when these beliefs are assessed prior to the patients actually beginning the rehabilitation program and engaging in their exercise. That is, in this study control beliefs were first assessed prior to the start of rehabilitation. At this time, patients have not had an exercise stress test, have not been given an exercise program, and are generally uncertain of what exercise they can do and will be doing. Assessing more general control beliefs prior to beginning rehabilitation may be more appropriate, as patients may be more likely to have an understanding of whether or not they think they have there are things they can do to influence or control their heart problem in general.

Finally, an all possible combination regression analysis (see Appendix 3- E) was performed in order to help clarify the association among the control beliefs to behavior during rehabilitation. Results of this analysis show that when entered separately, the self-efficacy beliefs were most strongly related to exercise during rehabilitation, followed by patient's perception of control over their heart problem and PBC. When any self-efficacy variable was added after patient's control over their heart problem, the influence of PCH was removed (i.e., PCH was no longer significant in the prediction of behavior during rehabilitation). This may suggest that PCH was redundant to SE beliefs at this time point. It may also suggest that SE mediates the influence of PCH on exercise behavior. Perhaps patients who believe that they have control over their heart problem were also more confident that they could exercise and therefore they were more likely to exercise during CR. Future research would need to test these ideas. Results from these analyses also showed that PBC was not a significant predictor of exercise during rehabilitation, even when it was entered by itself in the regression equation. This may suggest that for exercise during rehabilitation, PBC is not a relevant control belief.

Exercise Behavior After Cardiac Rehabilitation

After completing CR, coping self-efficacy and patients' perception of control over their heart problem were not significantly related to frequency of exercise. Scheduling self-efficacy and PBC showed the strongest association with exercise after CR, followed by task self-efficacy. These findings are not necessarily inconsistent with previous research. For example, Blanchard et al. (2007) found that barrier self-efficacy (similar to coping self-efficacy in this study) was related to behavior during CR, but not to exercise behavior after CR. Scheduling self-efficacy and PBC may be stronger correlates of

exercise after rehabilitation due to the context of this study and the nature of the CR program. That is, during rehabilitation, patients receive exercise programs to follow and 2 sessions of exercise are scheduled for them (at the CR unit) by program staff. However, once CR is complete, the patient becomes solely responsible for their exercise and as stated previously, the patient no longer has the same resources and opportunities for exercise. Therefore, PBC and planning and scheduling self-efficacy beliefs may be particularly salient at this time.

Results from the regression analyses predicting exercise after CR showed that age, scheduling and coping self-efficacy were the only significant predictors, with approximately 18% explained variance (i.e., R^2_{adj}) in the final model. Although this may seem like a relatively small amount of explained variance, it is similar to other studies examining predictors of behavior after CR (Blanchard et al., 2007; Carlson et al., 2001; Woodgate et al., 2005). SES, control over the heart problem, task self-efficacy and PBC did not emerge as significant predictors of exercise behavior after CR.

Whereas previous research has shown that individuals with higher SES are more likely to participate in CR (Grace et al., 2002; Harlan et al., 1995; Jackson et al., 2005), and CR patients with higher SES have better exercise capacity (Fraser et al., 2007; Ruo et al., 2002), results from this study show that SES was not a predictor of exercise behavior one month following rehabilitation. If CR creates a 'level playing field' by attenuating or mitigating the influence of SES on exercise *during* rehabilitation, perhaps the one-month time frame following rehabilitation is too short to capture SES influences on behavior. However, recall that income and social status were significant correlates of behavior after CR, suggesting that they do share important associations with exercise behavior

following rehabilitation. Moreover, although SES was not a significant predictor of behavior in this sample, it was related to control beliefs. Perhaps SES is influencing behavior, but it's effect is mediated through control beliefs. This is an important question for future research.

Among the control beliefs, scheduling and coping self-efficacy emerged as significant predictors of exercise behavior after CR. Additionally, age also emerged as significant predictor of behavior after rehabilitation. Younger patients were more likely to report moderate effort exercise after CR than older patients. Results from both the correlation and regression analyses suggested that scheduling self-efficacy beliefs play a key role in exercise behavior after cardiac rehabilitation. Although Blanchard et al., (2007) found that (barrier) self-efficacy did not predict exercise behavior after rehabilitation, other studies have found self-efficacy to be a significant predictor of exercise behavior after rehabilitation (Carlson et al., 2001; Woodgate et al., 2005). For example, similar to the results of this study, Woodgate et al. found that scheduling self-efficacy beliefs were the key predictor of exercise behavior after CR.

Other potential predictors, namely perceived control over the heart problem, task efficacy and PBC did not emerge as significant predictors of behavior after rehabilitation. Patients' perception of control over their heart problem may not be a significant correlate of exercise after rehabilitation as after attending CR patients may have a better understanding about the extent to which they can control their heart problem, and this belief may no longer be as salient as exercise specific beliefs in terms of explaining exercise behavior. Additionally, the finding that PBC was not as strong of a predictor as

self-efficacy is not novel. In the general exercise literature, self-efficacy has been found to be a stronger predictor of exercise behavior than PBC (Rodgers et al., in press-b).

Results from the all possible combination regression analyses (Appendix 3-F, model 30) further show that when PBC was entered after the three SE beliefs (i.e., task, coping and scheduling), it was not a significant predictor of behavior. This finding however may be depend upon the type of self-efficacy assessed. For example, when PBC and task self-efficacy were examined as predictors of behavior after CR (model 12), PBC emerged as the significant predictor of behavior. However, when scheduling SE and PBC were examined (model 15), neither variable emerged as a significant predictor of behavior, although the beta coefficient for scheduling self-efficacy (beta =.23, p = .13 two tailed) was higher than the beta coefficient for PBC (beta = .16). It is possible that the relatively small sample size limited power and as such scheduling self-efficacy did not emerge as significant (arguably a one tailed test could have been used in which case the p value would be p = .066 for scheduling self-efficacy). Thus, PBC may be a better predictor of behavior than task self-efficacy (or may be some redundant to task self-efficacy), but scheduling self-efficacy may be a better predictor of behavior after CR than PBC.

Together these findings support the importance conceptualizing self-efficacy in terms of multiple dimensions, (i.e., task, coping and scheduling self-efficacy). In the general exercise literature, task self-efficacy seems to play a more important role in the initial phases of exercise adoption (McAuley & Blissmer, 2000). Similar results seem to be emerging within the CR literature with regard to task self-efficacy. In general, research within CR settings (including this study) has shown that task self-efficacy seems

to be less important in terms of predicting behavior than the other types of self-efficacy (Blanchard et al., 2007; Maddison & Prapavessis, 2004; Woodgate et al., 2005).

In this study and in other CR studies (Blanchard et al., 2007), coping self-efficacy was not predictive or related to exercise behavior after rehabilitation, although coping efficacy has been related to behavior during rehabilitation. This is somewhat in contrast to research from the general exercise literature that shows that coping (and scheduling) self-efficacy was associated with longer term exercise behavior, or exercise maintenance (McAuley & Mihalko, 1998; Rodgers et al., 2002; Rodgers & Sullivan, 2001). But both this study and other studies (Woodgate et al., 2005) have found that scheduling self-efficacy is an important correlate of exercise behavior after rehabilitation. This finding highlights the importance of examining both coping and scheduling self-efficacy, as they may be differently related to behavior during and after rehabilitation. It may also speak to the role of the behavioral context of the CR program. As mentioned previously, prior to beginning CR, patients may be apprehensive and uncertain of their confidence to perform exercise, especially in consideration of their heart problem which they may view as a particular challenge. Thus coping efficacy may be particularly important during this time. During CR patients also receive a scheduled, structured exercise program and an environment to exercise in, are monitored by program staff, and have the support of other patients and staff. After CR, patients may no longer have the same resources and opportunities for exercise, and are likely solely responsible for planning their own exercise, making scheduling self-efficacy beliefs particularly important.

Finally, it is important to note that coping self-efficacy also had a significant beta coefficient in the regression model. However, the beta coefficient was negative. The zero

order correlation between coping self-efficacy and time 3 behavior was not significant (but was positive in direction). When an independent or predictor variable is not significantly (or significantly but positively) related to the DV or criterion variable, but increases the proportion of explained variance in a regression model and has a significant, but negative, coefficient in the prediction equation, it is termed a suppressor variable (Maassen & Bakker, 2001; MacKinnon, Krull & Lockwood, 2000). Thus, in the current study, coping self-efficacy appears to be acting as a suppressor variable. This may be because coping efficacy is related to (explaining) variability in scheduling self-efficacy. That is, a patient's ability to schedule exercise requires confidence for coping with the demands on exercise more generally (cf., MacKinnon et al.). This finding is not necessarily inconsistent with the conceptualization of the three different types of exercise used in this study, as scheduling self-efficacy beliefs are considered a subtype of coping efficacy beliefs (Rodgers & Sullivan, 2001).

There were several limitations that need to be considered when interpreting the findings of this study. First, the findings may be only generalizable to those who completed the study, and should be interpreted relative to the self-selected nature of the sample. Patient characteristics (i.e., age, marital status, smoking status, admitting diagnoses) in this study are similar to other studies from the NACRP (Fraser & Rodgers, in press; Fraser et al., 2007). However, participants in this study had slightly higher levels of educational attainment and income than previous studies from the same program (Fraser & Rodgers; Fraser et al.), although Fraser and colleagues reported higher levels of missing data on income that the current study. Thus, findings from this study may not generalize to other CR patients. Second, this study only looked at certain indicators of

SES and select control beliefs. Other factors have been shown to be important correlates of exercise in CR patients such as attitudes towards exercise (Blanchard et al., 2002a) and social support (Woodgate, Brawley & Shields, 2007). Third, a self-report assessment of exercise behavior was used throughout the study, and strenuous exercise was not assessed. This may have led to an overestimate of exercise behavior (Courneya, Jones, Rhodes & Blanchard, 2004). While program staff do monitor exercise behavior that is performed at the Glenrose Hospital, patients typically only perform half (or less) of their exercise on the unit. That is, during rehabilitation patients are advised to exercise a between 4 and 5 days per week, with only 2 of those days supervised at the Glenrose Hospital. A measure of behavior recorded on the unit may be more 'objective', but it would not be representative of patient's exercise behavior during the rehabilitation period.

The follow up period (exercise after CR) was also quite short (i.e., one month), and future research may benefit from examining exercise after CR over a longer period. Moreover, the measure of intentions included both verbal and numerical descriptors. Although the intentions measures had acceptable internal consistency and have been used in previous CR research (Blanchard et al., 2002b), the use of verbal descriptors has been highlighted as being potentially problematic (Courneya, Jones, Rhodes and Blanchard, 2003), and as such it may be prudent to avoid this practice in future research. Additionally, there were moderate to high correlations between the control variables and between the SES variables. Although there was no formal indication of multicollinearity (i.e., condition index and variance inflation factors) among the variables, the correlations suggest that the control variables are highly related. Multicollinearity is problematic in

regression analyses as severely limits the size of R, can lead to an unstable prediction equation and confounds the effects of the predictor variables, thereby potentially masking the effects of certain predictors, making if difficult to determine the importance of any given variable (Stevens, 2002). Thus, it is possible, for example, that in the hierarchical linear regression other SES indicators and other control beliefs were also important predictors of behavior during and after CR, but their effect was masked due to the correlations among them.

This study had a relatively small sample size which limited power. Additionally, there were a small number of women in this study, and examining potential gender differences was not possible. Some previous studies have shown that self-efficacy beliefs differ between men and women, with men being more efficacious than women (Blanchard et al., 2002b; Jenkins & Gortner, 1998). Future studies should attempt to include equal numbers of men and women to explore for potential gender differences (Blanchard et al., 2002a).

While this study has numerous limitations, it also has several conceptual and methodological strengths. First, multiple control beliefs, including multiple types of self-efficacy, were examined. Although scheduling self-efficacy has emerged as a significant predictor of exercise behavior in the general exercise literature, few studies have examined the influence of scheduling self-efficacy in CR patients (Woodgate et al., 2005). Most past studies in a CR setting have examined task and coping or barrier self-efficacy, and results from this study suggest that scheduling self-efficacy plays an important and unique role. Second, the majority of research has examined the influence of primarily self-efficacy beliefs on exercise behavior *during* rehabilitation only.

Exercising during CR is arguably different from exercising *after* CR where the exercise is no longer performed in a rehabilitation setting. Thus, it is also important to study factors that may be associated with exercise after CR, as different factors may influence behavior during and after rehabilitation.

From a practical perspective, results of this study suggest that interventions designed to increase exercise behavior during and after CR should be tailored to consider the different types of control beliefs (Woodgate et al., 2005). Specifically, before rehabilitation, patients perception of control over their heart problem may be a particularly important belief. During the rehabilitation period it may be useful to consider enhancing patients' confidence of their ability to schedule exercise into their lives in order to help promote behavioral persistence.

Endnotes

[1]A regression analysis with behavioral intentions was performed, and did not change the overall pattern of results. Intentions was not a significant predictor of behavior.

[2]An all possible combination regression analyses with the Time 1 control variables predicting behavior during rehabilitation was also performed to elucidate the nature of the relationship among each of the control variables in the prediction of behavior (see Appendix E). Results from an all possible combination analysis might suggest which control beliefs are important and which are redundant, which may allow for a subsequent regression analyses (examining SES and control beliefs) with a smaller set of control variables. Each variable was first entered separately, then in pairs and so on until all 5 variables were entered in subsequent steps. Results showed that when each control variable was entered by itself, it was a significant predictor of behavior, with the exception of PBC. When entered in pairs, control over the heart problem was no longer making a significant contribution when it was included with any of the self-efficacy variables (models 6-8). When task self-efficacy was included with coping self-efficacy, only task was significant. When task self-efficacy was included with scheduling self-efficacy, neither variable had a significant beta coefficient. When coping and scheduling self-efficacy were included together, scheduling was significant. When all three self-efficacy variables were included, there was no significant beta coefficient. Examination of the variance explained and error (MSE) suggest that model 13 might be the best solution, as it had at least one predictor with a significant beta coefficient, a high R^2, and a low MSE. However, when included in a regression with the SES variables, neither coping nor scheduling self-efficacy were significant. This finding was also true for any other combination of self-efficacy variables, such as task and coping self-efficacy. Therefore, no matter the combination of control variables included, once included in a regression analysis with the SES variables, the findings are similar to those presented in Table 2-5.

[3]A regression analysis with Time 2 intentions was performed, and intentions was not a significant predictor of behavior.

[4] An all possible combination regression analyses were also performed on the Time 2 control variables predicting Time 3 behavior (see Appendix F). Control over the heart problem (model 1) and coping self-efficacy (model 3) were not significant predictors of behavior. Task self-efficacy (model 2), scheduling self-efficacy (model 4) and PBC (model 5) all made an independent contribution to the prediction of behavior after CR. When all three variables (i.e., task, scheduling control over heart problem) were included together (model 24), not one variable had a significant beta coefficient, suggesting that this three variable combination was not a good solution. Potential two variable solutions were also examined. Model 15 contains scheduling and efficacy and PBC, both of which by themselves had the highest beta coefficients, but when entered as a pair neither variable had a significant beta coefficient. Model 11 containing task and scheduling self-efficacy appears to be the next best solution based on R^2 and MSE. When task and scheduling self-efficacy (and only task and scheduling self-efficacy) are included in a

regression with the SES variables, the results are similar to those presented in Table 2-6. That is, scheduling self-efficacy (beta = .43) is the only significant predictor of behavior after rehabilitation, with the total model explaining approximately 11% (R^2_{adj}) of the variance in behavior.

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Table 3-1. Demographic and medical profile of participants ($N = 129$)

Variable	*n* (%)
Sex	
Male	110 (85.3%)
Female	19 (14.7%)
Number of people living in household	
1	19 (14.7%)
2	70 (54.7%)
3	15 (11.6%)
4	18 (14.0%)
5	4 (3.1%)
6	1 (.8%)
8	1 (.8%)
Marital Status	
Married/common law	103 (79.8%)
Single/separated/divorced/widowed	26 (20.2%)
Employment Status	
Employed	72 (55.8%)
Not Employed	57 (44.2%)
Education	
Less than high school	10 (7.8%)
High school diploma	51 (39.5%)
Post secondary	68 (52.7%)
Household Income	
No income	1 (.8%)
$5 000 – $9 999	2 (1.6%)
$10 000 - $14 999	2 (1.6%)
$15 000 - $19 999	3 (2.3%)
$20 000 - $29 999	9 (7.0%)
$30 000 – $39 999	10 (7.8%)
$40 000 - $49 999	13 (10.1%)
$50 000 - $59 999	11 (8.5%)
$60 000 - $79 999	25 (19.4%)
$80 000 - $99 999	11 (8.5%)
$100 000 - $119 999	8 (6.2%)
$120 000 - $149 999	4 (3.1%)
$150 000 or more	10 (7.8%)
Missing	20 (15.5%)

Smoking History	
Never	30 (23.3%)
Former	92 (71.3%)
Current	7 (5.4%)
Admitting Diagnosis	
Myocardial infarction	71 (55.0%)
Bypass surgery	37 (28.7%)
Angioplasty	10 (7.8%)
Other	11 (8.5%)
Co morbidities*	
Stomach	20 (15.5%)
Arthritis/joint	44 (34.1%)
High Blood Pressure	14 (10.9%)
Diabetes	57 (44.2%)
High Cholesterol	30 (23.3%)
Other	78 (60.5%)

*co morbidities are not cumulative

Table 3-2. Descriptive statistics for study variables.

Variable	*n*	*M*	*SD*	Skewness (*SE*)	Kurtosis (*SE*)
Age	129	59.47	10.31	-.24 (.21)	-.05 (.42)
Body Mass Index	129	29.58	4.66	1.92 (.21)	8.46 (.42)
Education	129	2.44	.63	-.73 (.21)	-.46 (.46)
Income*	109	45101.67	24324.34	.69 (.23)	-.11 (.46)
Social Status	112	6.08	1.67	-.07 (.23)	.10 (.45)
T1 PC Heart	127	3.62	.70	-.67 (.22)	1.86 (.42)
T1 Task SE	125	86.07	16.84	-1.45 (.22)	1.45 (.43)
T1 Coping SE	123	68.59	23.78	-.89 (.22)	.18 (.43)
T1 Scheduling SE	123	83.47	18.68	-1.49 (.22)	2.19 (.43)
T1 PBC	127	6.10	.83	-1.05 (.22)	.80 (.43)
T1 Intentions	127	6.40	.68	-1.17 (.22)	1.11 (.43)
T1 Exercise (days per week)	128	1.73	2.58	1.63 (.21)	3.04 (.42)
T2 PC Heart	107	3.74	.62	-.53 (.23)	.63 (.46)
T2 Task SE	107	82.56	21.37	-1.99 (.23)	4.50 (.46)
T2 Coping SE	107	64.64	24.23	-.85 (.23)	.33 (.46)
T2 Scheduling SE	107	79.59	22.81	-1.57 (.23)	2.43 (.46)
T2 PBC	107	6.18	.90	-1.32 (.23)	1.83 (.46)
T2 Intentions	107	5.96	.99	-1.67 (.23)	3.45 (.46)
T2 Exercise (days per week)	107	3.26	2.23	-.08 (.23)	-1.01 (.46)
T3 Exercise (days per week)	107	3.10	2.34	.04 (.23)	-1.16 (.46)

Note. *Income adjusted for household size; T1 = Time 1; T2 = Time 2;T3 = Time 3; PC Heart = perceived control over heart problem; SE = self-efficacy; PBC = perceived behavioral control.

Table 3-3. Correlations between SES, control beliefs, exercise intentions and behavior.

Variables	Work Status (n = 129)	Income (n = 109)	Education (n = 129)	Social Status (n = 112)	T2 Exercise (n = 107)	T3 Exercise (n = 107)
T1 PC Heart (n = 127)	.09	.00	.03	.30**	.30**	.22*
T1 Task SE (n = 125)	.35**	.33**	.30**	.55**	.41**	.25*
T1 Cope SE (n = 123)	.19*	.33**	.35**	.48**	.39**	.24*
T1 Sched SE (n = 123)	.17	.15	.14	.33**	.41**	.36**
T1 PBC (n = 127)	.19*	.25**	.23*	.41**	.26**	.19*
T1 Intentions (n = 127)	.14	.16	.12	.28**	.15	.08
T2 PC Heart (n = 107)	.04	-.09	.03	.22*	.27**	.15
T2 Task SE (n = 107)	.16	.26*	.22*	.40**	.49**	.29*
T2 Cope SE (n = 107)	.14	.21*	.24*	.36**	.51**	.16
T2 Sched SE (n = 107)	.08	.14	.15	.31**	.55**	.35*
T2 PBC (n = 107)	.11	.12	.03	.29**	.35**	.34**
T2 Intentions (n = 107)	.00	-.02	.08	.11	.45**	.39**
T2 Exercise (n = 107)	.00	.17	.15	.17	-	.46**
T3 Exercise (n = 107)	-.10	.21*	.06	.23*	.46**	-

Note. * $p \leq .05$, ** $p < .01$ (two tailed); T1 = time one; T2 = time two; T3 = time three; PC Heart = perceived control over heart problem; Task SE = task self-efficacy; Cope SE = coping self-efficacy; Sched SE = scheduling self-efficacy; PBC = perceived behavioral control.

Table 3-4. Correlations between control beliefs, intentions and behavior.

Variable	1	2	3	4	5	6	7
Beginning of CR							
1. PC Heart	-						
2. Task SE	.48*	-					
3. Cope SE	.49*	.67*	-				
4. Sched SE	.40*	.70*	.64*	-			
5. PBC	.37*	.67*	.57*	.55*	-		
6. BI	.17	.43*	.31*	.35*	.57*	-	
7. Behavior during CR	.30*	.41*	.39*	.41*	.26*	.15	-
After CR							
1. PC Heart	-						
2. Task SE	.55*	-					
3. Cope SE	.48*	.78*	-				
4. Sched SE	.55*	.86*	.79*	-			
5. PBC	.52*	.67*	.56*	.80*	-		
6. BI	.43*	.60*	.53*	.78*	.76*	-	
7. Behavior after CR	.15	.29*	.16	.35*	.34*	.39*	-

Note. *$p < .01$; PC Heart = perceived control over heart problem; Task SE = task self-efficacy; Cope SE = coping self-efficacy; Sched SE = scheduling self-efficacy; PBC = perceived behavioral control; BI = behavioral intentions.

Table 3-5. Summary of Hierarchical Regression Analyses for SES and Time 1 Variables Predicting Time 2 Exercise Behavior ($n = 82$)

Variables	R	R^2_{adj}	β_1	p	β_2	p	β_3	p	β_4	p	β_5	p
Step 1	.45	.15										
Age			.00	.96	.03	.81	.05	.70	.06	.61	.06	.60
Gender			-.16	.16	-.16	.18	-.14	.25	-.19	.12	-.20	.11
BMI			-.04	.73	-.04	.71	-.04	.71	-.07	.51	-.08	.48
Exercise Capacity			.33	.01	.31	.02	.31	.02	.24	.09	.24	.09
Health Problems			.19	.08	.19	.08	.21	.05	.19	.08	.19	.08
Step 2	.47	.14										
Income					.08	.48	.15	.23	.10	.43	.10	.44
Education					.09	.38	.13	.24	.14	.22	.14	.24
Social Status					-.02	.86	-.12	.36	-.15	.26	-.15	.25
Step 3	.53	.19										
PC Heart							.26	.02	.16	.22	.15	.25
Step 4	.56	.20										
Task SE									-.05	.74	-.10	.61
Cope SE									.10	.53	.09	.59
Scheduling SE									.21	.19	.21	.19
Step 5	.57	.19										
PBC											.08	.63

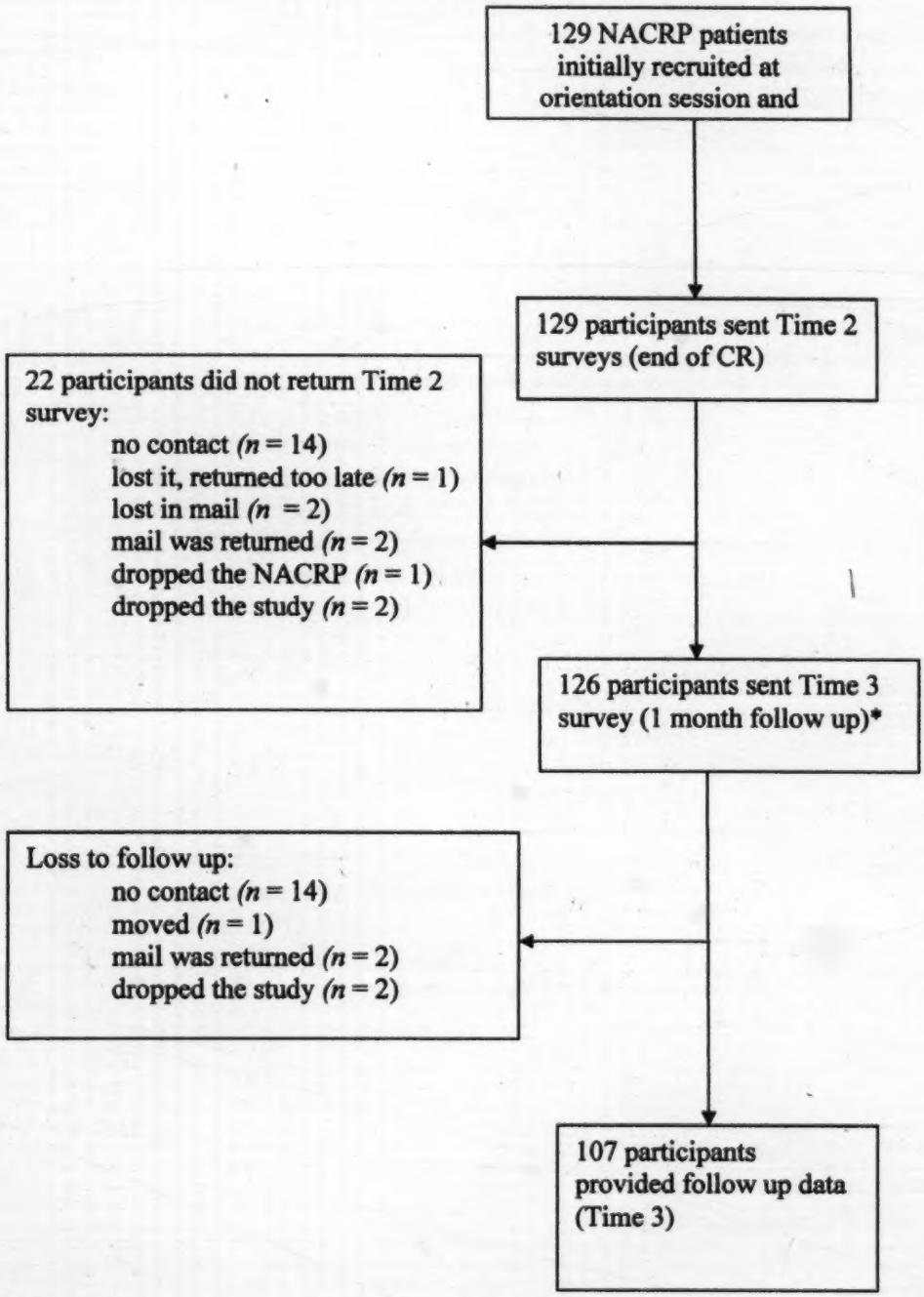
Note: $F_{Step\ 1}(5, 76) = 3.92, p < .01$; $F_{Step\ 2}(8, 73) = 2.59, p = .02$; $F_{Step\ 3}(9, 72) = 3.10, p < .01$; $F_{Step\ 4}(12, 69) = 2.69, p < .01$; $F_{Step\ 5}(13, 68) = 2.47, p < .01$; $F\Delta_{Step\ 2}(3, 73) = .51, p = .68$; $F\Delta_{Step\ 3}(1, 72) = 5.76, p = .02$; $F\Delta_{Step\ 4}(3, 69) = 1.34, p = .27$; $F\Delta_{Step\ 5}(1, 68) = .24, p = .63$.

Table 3-6. Summary of Hierarchical Regression Analyses for SES and Time 2 Variables Predicting Time 3 Exercise Behavior ($n = 81$)

Variables	R	R^2_{adj}	β_1	p	β_2	p	β_3	p	β_4	p	β_5	p
Step 1	.32	.05										
Age			-.26	.04	-.23	.08	-.25	.07	-.31	.02	-.30	.02
Gender			-.19	.12	-.16	.22	-.15	.25	-.21	.09	-.23	.08
BMI			-.20	.08	-.16	.18	-.16	.19	-.13	.26	-.13	.27
Exercise Capacity			-.08	.53	-.11	.43	-.10	.45	-.17	.20	-.16	.22
Health Problems			.13	.25	.13	.28	.13	.27	.00	.97	.01	.91
Step 2	.38	.05										
Income					.04	.77	.06	.69	-.02	.86	-.02	.85
Education					.03	.77	.03	.77	.08	.75	.09	.43
Social Status					.18	.19	.15	.31	.16	.24	.15	.27
Step 3	.39	.05										
PC Heart							.10	.41	-.04	.76	-.05	.71
Step 4	.55	.18										
Task SE									-.09	.69	-.09	.67
Cope SE									-.40	.03	-.38	.04
Scheduling SE									.72	.00	.65	.02
Step 5	.55	.17										
PBC											.08	.66

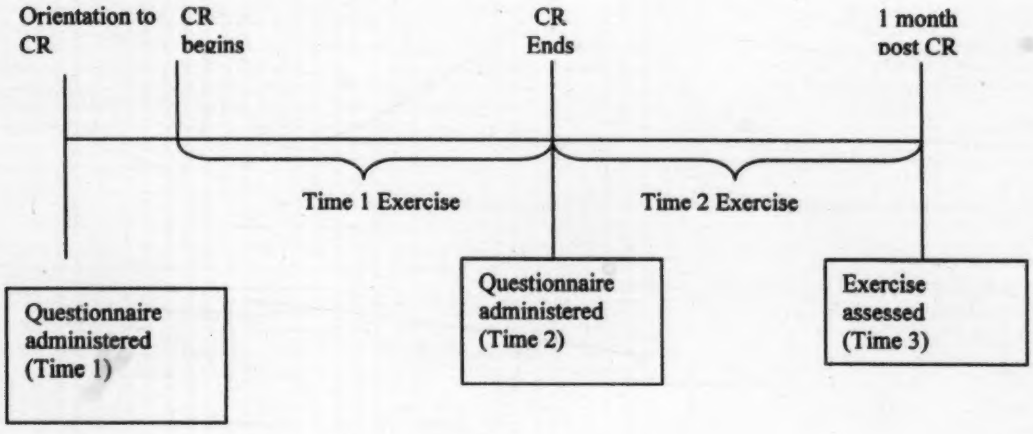
Note: $F_{Step\ 1}(5, 75) = 1.75, p = .13$; $F_{Step\ 2}(8, 80) = 1.53, p = .16$; $F_{Step\ 3}(9, 71) = 1.43, p = .19$; $F_{Step\ 4}(12, 68) = 2.46, p = .01$; $F_{Step\ 5}(13, 67) = 2.26, p = .02$; $F\Delta_{Step\ 2}(3, 72) = 1.14, p = .34$; $F\Delta_{Step\ 3}(1, 71) = .69, p = .41$; $F\Delta_{Step\ 4}(3, 68) = 4.86, p < .01$.; $F\Delta_{Step\ 5}(1, 67) = .20, p = .66$.

Figure 3-1. Flow of participants through the study


129 NACRP patients initially recruited at orientation session and
129 participants sent Time 2 surveys (end of CR)
22 participants did not return Time 2 survey:
no contact (n = 14)
lost it, returned too late (n = 1)
lost in mail (n = 2)
mail was returned (n = 2)
dropped the NACRP (n = 1)
dropped the study (n = 2)
126 participants sent Time 3 survey (1 month follow up)*
Loss to follow up:
no contact (n = 14)
moved (n = 1)
mail was returned (n = 2)
dropped the study (n = 2)
107 participants provided follow up data (Time 3)

*only participants who dropped the study or NACRP were not followed up

Figure 3-2. Study timeline and assessments.



Appendix 3-A

Information Letter

Project Title: The role of socioeconomic status and control beliefs in predicting health outcome and behavior in cardiac rehabilitation.

Investigators:

Terra Murray, PhD Candidate	Faculty of Physical Education and Recreation	492-7424
Wendy Rodgers, PhD	Faculty of Physical Education and Recreation	492-2677

Collaborators:

Bill Daub	Northern Alberta Cardiac Rehabilitation Program	735-8206
William Dafoe, MD	Northern Alberta Cardiac Rehabilitation Program	407-1624
Helen Stokes, PhD	Northern Alberta Cardiac Rehabilitation Program	735-6050

Purpose of the Study

Exercise is an important part of improving your health. But we know little about how to help people exercise into their life. This is especially true once their rehabilitation is done. The purpose of this study is to look at things that may influence your exercise during and after rehab. We are interested in seeing how thoughts you have about your heart problem and about exercise might help with rehab. We are also interested in what might affect these beliefs.

Procedure

If you agree to participate, please complete this survey. It will take you about 10 minutes to finish. Then take your survey to the orientation meeting at the Glenrose Hospital. We will meet you to collect the survey and answer any questions you might have. After you are done the rehab program (in about 8 weeks), we will ask you to complete another survey. This survey will be mailed to you. It will also take about 10 minutes. We will give you a postage paid envelope to mail this survey back to us. Finally, one month later, we will phone you to ask you a few questions about physical activity. This phone call will take about 5 minutes. Completing these surveys and the phone call is additional to the standard care you receive at rehab. To save time, Bill Daub will give us the following: your age, sex, marital status, education, employment status, height, weight, type of cardiac event and treatment, and stress test results. If you have any questions at any time about being in this study, please call Terra Murray or Wendy Rodgers at the phone numbers provided.

Voluntary participation

Being in this study is **not** required by the Glenrose program. As well, if you decide you do not want to be in this study, this will **not** affect your care at the Glenrose in any way. You may refuse to participate in the study. You may withdraw from the study at any time and this will not affect your care at rehab.

Risks and benefits

There are no known physical risks. But there is a chance that a question could make you feel uncomfortable. If this happens, there is a social worker who will be able to assist you by appointment. Also, you can skip any questions. It is important to know that d there is not any right or wrong answers to the survey questions. The information you provide will be used to develop future projects and to improve the current program.

By signing the consent form you give permission to the study staff to access any personally identifiable health information which is under the custody of other health care professionals as deemed necessary for the conduct of the research. All information will be kept private, except where professional codes of ethics or law require reporting. Terra Murray and Wendy Rodgers will be the only people who have access to your data. The data will be coded so your name will not appear. Only Terra Murray will have access to the code. The information you provide will be kept for at least five years after the study is done. The information will be kept in a locked filing cabinet. Your name or any other identifying information will not be attached to the information you gave. Your name will also never be used in any presentations or publications of the study results. If you have any questions about any aspect of this study, please contact the Patient Concerns Office of the Capital Health Authority at 407-1040. This office has no connection with the study investigators.

Please contact any of the researchers below if you have questions or concerns about the study:

Terra Murray, PhD candidate, 492-7424
Wendy Rodgers, PhD, 492-2677

Appendix 3-B

Tell us about yourself: Please answer the following questions based on your present situation. Please select the best response from the choices available. Remember all of the information you provide remains private.

Which of the following is your best guess of the **total income**, before taxes and deductions of **all household members** from all sources in the past year?

O No Income	O $30,000 – $39, 999	O $80,000 – $99, 999
O $5000 - $9999	O $40,000 – $49, 999	O $100,000 - $119, 999
O $10, 000 – $14, 999	O $50,000 – $59, 999	O $120, 000 – 149, 999
O $15,000 – $19, 999	O $60,000 – $79, 999	O $150, 000 or more
O $20,000 – $29, 999		

Including yourself, how many people live at your household? _____ (number of people)

Think of this ladder as representing where people stand in society.

At the top of the ladder are the people who are though to be higher in society, they have the most money, most education and the best jobs.
At the bottom are the people who are thought to be the worst off, who have the least money, least education and the worst jobs or no job.

The higher up you are on this ladder, the closer you are to people at the very top and the lower you are, the closer you are to the bottom.

Where would you put yourself on the ladder?

Please place a large 'X' on the rung where you think you stand

Over the past month, consider a typical week (7 days): How many times on the average do YOU do the following kind of exercise for more than 15 minutes during your free time? On average, how many minutes do you do that type of activity for? If you have not been exercising, simply report "0".		
	Times per week	**Average duration**
Mild Activity (low effort, no perspiration) (e.g., easy walking, yoga, bowling, lawn bowling, golf, snowmobiling)	_____	_____
Moderate Activity (not exhausting, light perspiration) (e.g., brisk walking, tennis, bicycling, volleyball, badminton, easy swimming, dancing, light weight training)	_____	_____

Some people believe that they have control over the course of their heart problem. This can be due to a positive attitude, dietary, exercise changes, or something else.

Rate the extent that you think you can control:

	No Control		Some Control		Complete Control
a). The future course of your heart problem – that is, how you will feel physically in the future	1	2	3	4	5
b). The type of medical care that you receive	1	2	3	4	5
c). Your emotions and feelings about your heart problem	1	2	3	4	5
d). Your day to day symptoms, such as fatigue, pain, or other symptoms.	1	2	3	4	5

The staff at the cardiac rehab program will be giving you a prescribed exercise program to follow during your rehab period. Please answer the questions below concerning your thoughts and plans for exercise during rehab.

	Strongly Disagree						Strongly Agree
1. How much I exercise during rehab is completely up to me?	1	2	3	4	5	6	7
2. I believe I have the resources required to exercise during rehab	1	2	3	4	5	6	7
3. I believe I have the opportunities to exercise during rehab	1	2	3	4	5	6	7
4. I believe I have all the things I need to exercise during rehab	1	2	3	4	5	6	7
5. I intend to exercise regularly during rehab?	1	2	3	4	5	6	7
6. I intend to attend my scheduled exercise classes during my rehabilitation program?	1	2	3	4	5	6	7

7. My goal during rehab is to attend:

1 2 3 4 5 6 7

Some scheduled Exercise classes — *Most scheduled exercise classes* — *Every scheduled exercise class*

8. How confident are you that you can exercise during rehab?

1 2 3 4 5 6 7

Not Confident — *Very Confident*

9. How much personal control do you feel you have over exercising during rehab?

1 2 3 4 5 6 7

No Control — *Complete Control*

10. To what extent do you see yourself as being capable of exercising during rehab?

1 2 3 4 5 6 7

Not Capable — *Very Capable*

The staff at the cardiac rehab program will be giving you a prescribed exercise program to follow during your rehab period. Please answer the questions below concerning your confidence about completing the exercise during your rehab period.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No confidence								Complete Confidence		

How confident are you that you can...

Complete exercise using proper technique	%
Follow directions to complete the exercise	%
Perform all of the movements required for the exercise	%
Exercise when you feel discomfort from the activity	%
Exercise when you lack energy	%
Include exercise in your daily routine	%
Consistently exercise 3-4 days each week	%
Exercise when you feel under the weather (cold, flu)	%
Arrange your schedule to include regular exercise	%

Over the past month, consider a typical week (7 days): How many times on the average did YOU do the following kind of exercise for more than 15 minutes during your free time?		
	Times per week	**Average duration**
Mild Activity (low effort, no perspiration) (e.g., easy walking, yoga, bowling, lawn bowling, golf, snowmobiling)	_____	_____
Moderate Activity (not exhausting, light perspiration) (e.g., brisk walking, tennis, bicycling, volleyball, badminton, easy swimming, dancing, light weight training)	_____	_____

Some people believe that they have control over the course of their heart problem. This can be due to a positive attitude, dietary or exercise changes or something else.

Rate the extent to which you think you can control:	No control			Some control	Complete control
a). The future course of your heart problem – that is how you will feel physically in the future	1	2	3	4	5
b). The type of medical care that you receive	1	2	3	4	5
c). Your emotions and feelings about your heart problem	1	2	3	4	5
d). Your day to day symptoms, such as fatigue, pain or other symptoms	1	2	3	4	5

Please indicate HOW CONFIDENT YOU ARE THAT YOU CAN PERFORM each of the exercise related tasks below. Exercise refers to <u>your home exercise program</u> given to you by the cardiac rehab staff.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No confidence										Complete Confidence

How confident are you that you can...

Complete your exercise (home program) using proper technique	%
Follow directions to complete your exercise	%
Perform all of the movements required for your exercise	%
Exercise when you feel discomfort from the activity	%
Exercise when you lack energy	%
Include exercise in your daily routine	%
Consistently exercise 4 days each week	%
Exercise when you feel under the weather (cold, flu)	%
Arrange your schedule to include regular exercise	%

The following questions refer to your plans and thoughts for exercise. Remember that exercise means following your home exercise program. Choose the response that best fits with how you think right now.

How much do you agree with the following?	Strongly Disagree						Strongly Agree
1. How much I exercise over the next month is completely up to me?	1	2	3	4	5	6	7
2. I believe I have the resources required to exercise over the next month	1	2	3	4	5	6	7
3. I believe I have the opportunities to exercise over the next month	1	2	3	4	5	6	7
4. I believe I have all the things I need to exercise over the next month	1	2	3	4	5	6	7
5. I intend to exercise regularly during the next month?	1	2	3	4	5	6	7
6. I intend to exercise at least 4 days a week over the next month?	1	2	3	4	5	6	7

7. My goal over the next month is to exercise:

1	*2*	*3*	*4*	*5*	*6*	*7*
Not at all		*Once in a While*		*Every other day*		*Every day*

8. How confident are you that you can exercise over the next month?

1	*2*	*3*	*4*	*5*	*6*	*7*
Not Confident						*Very Confident*

9. How much personal control do you feel you have over exercising over the next month?

1	*2*	*3*	*4*	*5*	*6*	*7*
No Control						*Complete Control*

10. To what extent do you see yourself as being capable of exercising over the next month ?

1	*2*	*3*	*4*	*5*	*6*	*7*
Not Capable						*Very Capable*

Over the past month, consider a typical week (7 days): How many times on the average did YOU do the following kind of exercise for more than 15 minutes during your free time?		
	Times per week	**Average duration**
Mild Activity (low effort, no perspiration) (e.g., easy walking, yoga, bowling, lawn bowling, golf, snowmobiling)	_____	_____
Moderate Activity (not exhausting, light perspiration) (e.g., brisk walking, tennis, bicycling, volleyball, badminton, easy swimming, dancing, light weight training)	_____	_____

Appendix 3-E

Prediction of Time 2 behavior from Time 1 control beliefs

		Estimated coefficients								
model	variables	β1	β2	β3	β4	β5	Overall *F*	R^2	Δ R^2	MSE
1	PCH	.30*					10.13	.09	-	4.69
2	Task		.40*				19.82	.16	-	4.23
3	Cope			.39*			18.30	.16	-	4.37
4	Sched				.41*		20.56	.17	-	4.29
5	PBC					.26	7.35	.07	-	4.75
6	PCH Task	.11	.36*				10.47	.18	a	4.32
7	PCH Cope	.10		.34*			9.53	.16	b	4.42
8	PCH Sched	.11			.37*		11.01	.18	c	4.31
9	PCH PBC	.23*				.18	6.59	.12	d	4.63
10	Task Cope		.26*	.22			11.63	.19	e	4.23
11	Task Sched		.22		.25		11.79	.19	f	4.21
12	Task PBC		.40*			.00	9.59	.16	g	4.36
13	Cope Sched			.22	.27*		12.13	.20	h	4.19
14	Cope PBC			.35*		.08	9.15	.16	i	4.43
15	Sched PBC				.37*	.07	10.25	.17	j	4.35
16	PCH Task Cope	.06	.24	.20			7.73	.19	k	4.30
17	PCH Task Sched	.08	.20		.24		8.07	.18	l	4.27
18	PCH Task PBC	.10	.38*			-.01	6.75	.17	m	4.40
19	PCH Cope Sched	.07		.18	.26*		8.10	.20	n	4.26

		Estimated coefficients								
model	variables	β1	β2	β3	β4	β5	Overall F	R^2	Δ R^2	MSE
20	PCH Cope PBC	.09		.31*		.06	6.23	.16	o	4.49
21	PCH Sched PBC	.10			.35*	.04	7.18	.18	p	4.38
22	Task Cope Sched		.15	.16	.19		8.46	.21	q	4.19
23	Task Cope PBC		.28*	.23		-.05	7.58	.19	r	4.31
24	Task Sched PBC		.23		.26	-.03	7.66	.19	s	4.30
25	Cope Sched PBC			.21	.27*	.00	7.87	.20	t	4.27
26	PCH Task Cope Sched	.05	.14	.14	.19		6.31	.21	u	4.26
27	PCH Task Cope PBC	.06	.27	.21		-.06	5.67	.19	v	4.38
28	PCH Task Sched PBC	.08	.21		.25	-.04	5.90	.20	w	4.34
29	PCH Cope Sched PBC	.07		.19	.27*	-.01	5.90	.20	x	4.35
30	Task Cope Sched PBC		.18	.18	.20	.06	6.24	.21	y	4.26
31	PCH Task Cope Sched PBC	.05	.18	.15	.20	-.06	4.96	.21	z	4.34

note. * $p < .05$; All F's significant at $p \leq .001$; PCH = perceived control over heart problem; Task = task self-efficacy, Cope coping self-efficacy; Sched = scheduling self-efficacy; β1 refers to the beta coefficient for model 1 or perceived control over heart problem; β2 refers to the beta coefficient for task self-efficacy; β3 refers to the beta coefficient for coping self-efficacy; β4 refers to the beta coefficient for scheduling self-efficacy; β5 refers to the beta coefficient for PBC.

a. Addition of Task after PCH did significantly increase R^2 ($\Delta R^2 = .10, p = .001$); addition of PCH after Task did not significantly increase R^2($\Delta R^2 = .01, p = 31$).
b. Addition of Cope after PCH did significantly increase R^2 ($\Delta R^2 = .09, p = .002$); addition of PCH after Cope did not significantly increase R^2($\Delta R^2 = .01, p = .34$).
c. Addition of Sched after PCH did significantly increase ($\Delta R^2 = .11, p < .001$); addition of PCH after scheduling did not significantly increase R^2($\Delta R^2 = .01, p = .26$).
d. Addition of PBC after PCH did not significantly increase R^2($\Delta R^2 = .03, p = .08$); addition of PCH after PBC did significantly increase R^2($\Delta R^2 = .05, p = .02$).
e. Addition of Cope after Task did not significantly increase R^2($\Delta R^2 = .03, p = .07$); addition of Task after Cope did significantly increase R^2($\Delta R^2 = .04, p = .04$).
f. Addition of Sched after Task did not significantly increase R^2($\Delta R^2 = .03, p = .06$); addition of Task after Sched did not significantly increase R^2($\Delta R^2 = .02, p = .11$).
g. Addition of PBC after Task did not significantly increase R^2($\Delta R^2 = .00, p = .99$); addition of Task after PBC did significantly increase R^2($\Delta R^2 = .08, p = .002$).
h. Addition of Sched after Cope did significantly increase R^2($\Delta R^2 = .04, p = .03$); addition of Cope after Sched did not significantly increase R^2($\Delta R^2 = .03, p = .08$).
i. Addition of PBC after Cope did not significantly increase R^2($\Delta R^2 = .00, p = .50$); addition of Cope after PBC did significantly increase R^2($\Delta R^2 = .08, p = .003$).
j. Addition of PBC after Sched did not significantly increase R^2($\Delta R^2 = .00, p = .56$); addition of Sched after PBC did significantly increase R^2($\Delta R^2 = .09, p = .001$).
k. Addition of Cope after PCH & Task did not significantly increase R^2($\Delta R^2 = .02, p = .13$); addition of Task after PCH &Cope did not significantly increase R^2($\Delta R^2 = .03, p = .06$); addition of PCH after Task & Cope did not significantly increase R^2($\Delta R^2 = .00, p = .57$).
l. Addition of Sched after PCH & Task did not significantly increase R^2($\Delta R^2 = .03, p = .08$); addition of Task after PCH & Sched did not significantly increase R^2($\Delta R^2 = .02, p = .16$); addition of PCH after Task & Sched did not significantly increase R^2($\Delta R^2 = .01, p = .45$).
m. Addition of PBC after PCH &Task did not significantly increase R^2($\Delta R^2 = .00, p = .92$); addition of Task after PCH & PBC did significantly increase R^2($\Delta R^2 = .09, p = .01$); addition of PCH after Task & PBC did not significantly increase R^2($\Delta R^2 = .01, p = .33$).
n. Addition of Sched after PCH & Cope did significantly increase R^2($\Delta R^2 = .04, p = .04$); addition of Cope after PCH & Sched did not significantly increase R^2($\Delta R^2 = .02, p = .16$); addition of PCH after Cope & Sched did not significantly increase R^2($\Delta R^2 = .00, p = .52$).

o. Addition of PBC after PCH & Cope did not significantly increase $R^2(\Delta R^2 = .00, p = .63)$; addition of Cope and PHC & PBC did significantly increase $R^2(\Delta R^2 = .06, p = .01)$; addition of PCH after Cope & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .42)$.

p. Addition of PBC after PCH & Sched did not significantly increase $R^2(\Delta R^2 = .00\ p = .71)$; addition of Sched after PCH & PBC did significantly increase $R^2(\Delta R^2 = .08, p < .01)$; addition of PCH after Sched & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .34)$.

q. Addition of Sched after Task & Cope did not significantly increase $R^2(\Delta R^2 = .02, p = .17)$; addition of Cope after Task & Sched did not significantly increase $R^2(\Delta R^2 = .01, p = .20)$; addition of Task after Cope & Sched did not significantly increase $R^2(\Delta R^2 = .01, p = .30)$.

r. Addition of PBC after Task & Cope did not significantly increase $R^2(\Delta R^2 = .00, p = .69)$; addition of Cope after Task & PBC did not significantly increase $R^2(\Delta R^2 = .03, p = .07)$; addition of Task after Cope & PBC did significantly increase $R^2(\Delta R^2 = .04, p = .05)$.

s. Addition of PBC after Task & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .82)$; addition of Sched after Task & PBC did not significantly increase $R^2(\Delta R^2 = .03, p = .06)$; addition of Task after Sched & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .14)$.

t. Addition of PBC after Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .96)$; addition of Sched after Cope & PBC did significantly increase $R^2(\Delta R^2 = .04, p = .03)$; addition of Cope after Sched & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .10)$.

u. Addition of Sched after PCH, Task & Cope did not significantly increase $R^2(\Delta R^2 = .02, p = .18)$; addition of Task after PCH, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .01, p = .33)$; addition of Cope after PCH, Task & Sched did not significantly increase $R^2(\Delta R^2 = .01, p = .35)$; addition of PCH after Task, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .62)$.

v. Addition of PBC after PCH, Task, & Cope did not significantly increase $R^2(\Delta R^2 = .00, p = .67)$; addition of Task after PCH, Cope & PBC did not significantly increase $R^2(\Delta R^2 = .03, p = .07)$; addition of Cope after PCH, Task & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .12)$; addition of PCH after Task, Cope & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .57)$.

w. Addition of PBC after PCH, Task & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .78)$; addition of Task after PCH, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .18)$; addition of Sched after PCH, Task & PBC did not significantly increase $R^2(\Delta R^2 = .03, p = .08)$; addition of PCH after Task, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .46)$.

x. Addition of PBC after PCH, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .94)$; addition of Cope after PCH, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .18)$; addition of Sched after PCH, Cope & PBC did significantly increase $R^2(\Delta R^2 = .04, p = .04)$; addition of PCH after Cope, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .55)$.

y. Addition of PBC after Task, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .62)$; addition of Cope after Task, Sched & PBC did not significantly

increase $R^2(\Delta R^2 = .02, p = .19)$; addition of Sched after Task, Cope & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .16)$; addition of Task after Cope, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .26)$.

z. Addition of PBC after PCH, Task, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .62)$; addition of Task After PCH, Cope, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .28)$; addition of Cope after PCH, Task, Sched &PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .28)$; addition of Sched after PCH, Task, Cope and PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .17)$; addition of PCH after Task, Cope, Sched and PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .62)$.

Appendix 3-F

Prediction of Time 3 behavior from Time 2 control beliefs.

		Estimated coefficients								
model	variables	β1	β2	β3	β4	β5	Overall *F*	R^2	Δ R^2	MSE
1	PCH	.15					2.08 *(ns)*	.02	-	5.43
2	Task		.29*				8.67	.08	-	5.09
3	Cope			.16			2.46 *(ns)*	.03	-	5.41
4	Sched				.35*		13.83	.13	-	4.85
5	PBC					.34*	12.37	.11	-	4.91
6	PCH Task	-.01	.29*				4.29	.08	a	5.15
7	PCH Cope	.09		.12			1.58 *(ns)*	.03	b	5.43
8	PCH Sched	-.04			.37*		6.92	.13	c	4.90
9	PCH PBC	-.02				.35*	6.14	.11	d	4.97
10	Task Cope		.40*	-.15			4.80	.09	e	5.10
11	Task Sched		-.05		.40*		6.89	.13	f	4.90
12	Task PBC		.12			.26*	6.60	.12	g	4.93
13	Cope Sched			-.29*	.58*		9.07	.16	h	4.71
14	Cope PBC			-.03		.35*	6.15	.11	i	4.96
15	Sched PBC				.23	.16	7.44	.13	j	4.85
16	PCH Task Cope	.00	.40*	-.15			3.12	.09	k	5.15
17	PCH Task Sched	-.04	-.04		.41*		4.59	.13	l	4.95
18	PCH Task PBC	-.06	.14			.28*	4.45	.12	m	4.97
19	PCH Cope Sched	-.02		-.29	.59*		6.00	.16	n	4.76

		Estimated coefficients								
model	variables	β1	β2	β3	β4	β5	Overall F	R^2	ΔR^2	MSE
20	PCH Cope PBC	-.02		-.02		.36*	4.06	.11	o	5.02
21	PCH Sched PBC	-.06			.25	.17	5.03	.14	p	4.89
22	Task Cope Sched		.06	-.31*	.54*		6.03	.16	q	4.76
23	Task Cope PBC		.24	-.16		.27*	4.81	.13	r	4.92
24	Task Sched PBC		-.06		.27	.15	4.93	.14	s	4.90
25	Cope Sched PBC			-.27	.49*	.10	6.14	.16	t	4.74
26	PCH Task Cope Sched	-.03	.07	-.31*	.55*		4.50	.16	u	4.80
27	PCH Task Cope PBC	-.05	.25	-.16		.28*	3.62	.13	v	4.96
28	PCH Task Sched PBC	-.06	-.02		.27	.17	3.74	.14	w	4.94
29	PCH Cope Sched PBC	-.04		-.27	.50*	.11	4.59	.16	x	4.79
30	Task Cope Sched PBC		.06	-.29	.45	.10	4.58	.16	y	4.79

Estimated coefficients										
model	variables	β1	β2	β3	β4	β5	Overall *F*	R^2	Δ R^2	MSE
31	PCH Task Cope Sched PBC	-.05	.07	-.28	.45	.11	3.67	.17	z	4.83

note. * $p <$ .05; All *F*'s significant at $p \leq .01$ unless otherwise noted; PCH = control over heart problem; Task = task self-efficacy, Cope coping self-efficacy; Sched = scheduling self-efficacy; β1 refers to the beta coefficient for model 1 or perceived control over heart problem; β2 refers to the beta coefficient for task self-efficacy; β3 refers to the beta coefficient for coping self-efficacy; β4 refers to the beta coefficient for scheduling self-efficacy; β5 refers to the beta coefficient for PBC.

a. Addition of Task after PCH did significantly increase R^2 ($\Delta R^2 = .05, p = .02$); addition of PCH after Task did not significantly increase R^2($\Delta R^2 = .02, p = .16$).
b. Addition of Cope after PCH did not significantly increase R^2 ($\Delta R^2 = .01, p = .30$); addition of PCH after Cope did not significantly increase R^2($\Delta R^2 = .01, p = .40$).
c. Addition of Sched after PCH did significantly increase ($\Delta R^2 = .11, p < .001$); addition of PCH after scheduling did not significantly increase R^2($\Delta R^2 = .00, p = .70$).
d. Addition of PBC after PCH did significantly increase R^2($\Delta R^2 = .09, p = .002$); addition of PCH after PBC did not significantly increase R^2($\Delta R^2 = . p = .84$).
e. Addition of Cope after Task did not significantly increase R^2($\Delta R^2 = .01, p = .34$); addition of Task after Cope did significantly increase R^2($\Delta R^2 = .07, p = .01$).
f. Addition of Sched after Task did significantly increase R^2($\Delta R^2 = .04, p = .03$); addition of Task after Sched did not significantly increase R^2($\Delta R^2 = .00, p = .76$).
g. Addition of PBC after Task did significantly increase R^2($\Delta R^2 = .04, p = .04$); addition of Task after PBC did not significantly increase R^2($\Delta R^2 = .01, p = .36$).
h. Addition of Sched after Cope did significantly increase R^2($\Delta R^2 = .13, p < .001$); addition of Cope after Sched did significantly increase R^2($\Delta R^2 = .03, p = .05$).
i. Addition of PBC after Cope did significantly increase R^2($\Delta R^2 = .09, p = .003$); addition of Cope after PBC did not significantly increase R^2($\Delta R^2 = .00, p = .82$).
j. Addition of PBC after Sched did not significantly increase R^2($\Delta R^2 = .01, p = .10$); addition of Sched after PBC did not significantly increase R^2($\Delta R^2 = .02, p = .06$).
k. Addition of Cope after PCH & Task did not significantly increase R^2($\Delta R^2 = .02, p = .34$); addition of Task after PCH &Cope did not significantly increase R^2($\Delta R^2 = .06, p = .02$); addition of PCH after Task & Cope did not significantly increase R^2($\Delta R^2 = .00, p = .99$).
l. Addition of Sched after PCH & Task did significantly increase R^2($\Delta R^2 = .04, p = .03$); addition of Task after PCH & Sched did not significantly increase R^2($\Delta R^2 = .00, p = .83$); addition of PCH after Task & Sched did not significantly increase R^2($\Delta R^2 = .00, p = .74$).

m. Addition of PBC after PCH &Task did significantly increase $R^2(\Delta R^2 = .04, p = .04)$; addition of Task after PCH & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .31)$; addition of PCH after Task & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .61)$.

n. Addition of Sched after PCH & Cope did significantly increase $R^2(\Delta R^2 = .13, p < .001)$; addition of Cope after PCH & Sched did not significantly increase $R^2(\Delta R^2 = .03, p = .06)$; addition of PCH after Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .83)$.

o. Addition of PBC after PCH & Cope did significantly increase $R^2(\Delta R^2 = .08, p = .004)$; addition of Cope after PHC & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .86)$; addition of PCH after Cope & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .88)$.

p. Addition of PBC after PCH & Sched did not significantly increase $R^2(\Delta R^2 = .01\ p = .28)$; addition of Sched after PCH and PBC did not significantly increase $R^2(\Delta R^2 = .03, p = .11)$; addition of PCH after Sched & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .56)$.

q. Addition of Sched after Task & Cope did significantly increase $R^2(\Delta R^2 = .07, p = .006)$; addition of Cope after Task & Sched did significantly increase $R^2(\Delta R^2 = .03, p = .05)$; addition of Task after Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .74)$.

r. Addition of PBC after Task & Cope did significantly increase $R^2(\Delta R^2 = .04, p = .04)$; addition of Cope after Task & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .28)$; addition of Task after Cope & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .16)$.

s. Addition of PBC after Task & Sched did not significantly increase $R^2(\Delta R^2 = .01, p = .32)$; addition of Sched after Task & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .22)$; addition of Task after Sched & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .80)$.

t. Addition of PBC after Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .53)$; addition of Sched after Cope & PBC did significantly increase $R^2(\Delta R^2 = .05, p = .02)$; addition of Cope after Sched & PBC did not significantly increase $R^2(\Delta R^2 = .03, p = .08)$.

u. Addition of Sched after PCH, Task & Cope did significantly increase $R^2(\Delta R^2 = .07, p = .006)$; addition of Task after PCH, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .71)$; addition of Cope after PCH, Task & Sched did significantly increase $R^2(\Delta R^2 = .03, p = .05)$; addition of PCH after Task, Cope & Sched did not significantly increase $R^2(\Delta R^2 = .00, p = .76)$.

v. Addition of PBC after PCH, Task, Cope & PBC did significantly increase $R^2(\Delta R^2 = .04, p = .03)$; addition of Task after PCH, Cope & PBC did not significantly increase $R^2(\Delta R^2 = .02, p = .15)$; addition of Cope after PCH, Task & PBC did not significantly increase $R^2(\Delta R^2 = .01, p = .29)$; addition of PCH after Task, Cope & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .65)$.

w. Addition of PBC after PCH, Task & Sched did not significantly increase $R^2(\Delta R^2 = .01, p = .29)$; addition of Task after PCH, Sched & PBC did not significantly increase $R^2(\Delta R^2 = .00, p = .90)$; addition of Sched after PCH, Task & PBC did

not significantly increase R^2($\Delta R^2 = .01, p = .22$); addition of PCH after Task, Sched & PBC did not significantly increase R^2($\Delta R^2 = .00, p = .61$).

x. Addition of PBC after PCH, Cope & Sched did not significantly increase R^2($\Delta R^2 = .00, p = .50$); addition of Cope after PCH, Sched & PBC did not significantly increase R^2($\Delta R^2 = .03, p = .09$); addition of Sched after PCH, Cope & PBC did significantly increase R^2($\Delta R^2 = .05, p = .02$); addition of PCH after Cope, Sched & PBC did not significantly increase R^2($\Delta R^2 = .00, p = .73$).

y. Addition of PBC after Task, Cope & Sched did not significantly increase R^2($\Delta R^2 = .00, p = .54$); addition of Cope after Task, Sched & PBC did not significantly increase R^2($\Delta R^2 = .03, p = .08$); addition of Sched after Task, Cope & PBC did not significantly increase R^2($\Delta R^2 = .03, p = .06$); addition of Task after Cope, Sched & PBC did not significantly increase R^2($\Delta R^2 = .00, p = .76$).

z. Addition of PBC after PCH, Task, Cope & Sched did not significantly increase R^2($\Delta R^2 = .00, p = .50$); addition of Task After PCH, Cope, Sched & PBC did not significantly increase R^2($\Delta R^2 = .00, p = .70$); addition of Cope after PCH, Task, Sched & PBC did not significantly increase R^2($\Delta R^2 = .03, p = .08$); addition of Sched after PCH, Task, Cope and PBC did not significantly increase R^2($\Delta R^2 = .03, p = .07$); addition of PCH after Task, Cope, Sched and PBC did not significantly increase R^2($\Delta R^2 = .00, p = .69$).

4. DISCUSSION

Perceptions of control have been recognized as a key cognition in health and behavioral research (Skinner; 1996; Steptoe & Appels, 1989; Steptoe & Wardle, 2001). People who perceive that they have control over their lives and life domains report better health and well being (Bailis, Segall, Mahon, Chipperfield & Dunn, 2001; Lachman & Weaver; 1998a; 1998b; Marmot, Fuhrer, Ettner, Marks & Bumpass, 1998), and are more likely to engage in health promoting behaviors (Armitage. 2005; Bandura, 1997; Conner & Norman, 1996; Eyler et al., 2003; McAuley et al., 2007; Ziff, Conrad & Lachman, 1995). Socioeconomic status, a key determinant of health and health behavior (Adler, 2001; Marmot, Shilpey & Rose, 1984; Marmot & Shipley, 1996; Syme, 2001), has also been linked to perceptions of control (Bailis et al.; Clark, 1995; Lachman & Weaver; Marmot, 2006). People with higher SES generally report a greater sense of control over their life. The importance of perceived control is reflected in many modern health behavior theories which include some aspect of control as an influence on behavior (Conner & Norman, 1996). However, some researchers have argued that research on control has been hampered by its own success (Haidt & Rodin, 1999). Numerous control related constructs and measures have been developed (Haidt & Rodin; Lachman, 2000; Skinner, 1996) and the extent to which control related constructs are distinct has become an important issue (Rodgers et al., in press; Skinner; Trafimow et al., 2002). Further, research examining exercise tends to focus on behavioral specific control beliefs, but more generalized control beliefs may also be important (Armitage, 2003).

Despite the relatively large amount of research on social cognitive determinants of behavior, the relationship between given determinants, including control beliefs, and

indicators of SES has received little attention (Sheeran & Abraham, 1996; Leganger & Kraft, 2003). The goal of these two dissertation studies was to examine the influence of different kinds of control beliefs on exercise intentions and behavior, and how control beliefs function with a key determinant of health and health behavior, SES.

The results of these studies may contribute to our understanding of the different kinds of control, and their role in the relation between indicators of SES and exercise. Both studies found that control beliefs were related to each other. This is not surprising given that all beliefs reflect the extent to which the individual believes that they have control over an event or outcome. However, the control beliefs also differ from each other. For example, in Study 1 it was found that mastery, self-efficacy and PBC could be differentiated from each other, and thus these different types of control did not appear to be redundant to each other. Mastery beliefs were specified at a general level (i.e., control over life) sitting at the far end of the continuum of specificity of control beliefs. Both self-efficacy and PBC were specified at the level of the behavior, in this case exercise. In study 2, control over the heart problem was examined, which would sit at the middle of the continuum of control beliefs. However, there also other ways in which these beliefs differ. Self-efficacy differs from PBC in that efficacy was more concerned with capability and confidence to perform a given behavior, and PBC was more concerned with perceptions of 'controllability' of the behavior, including having adequate resources and opportunities. Both mastery beliefs and control over the heart problem were also more concerned with 'controllability' than with capability and confidence.

Ajzen (2002) states that control over behaviors is best considered a matter of degree (more or less control), as opposed to the 'kind' of control. While certainly having

more control appears to be beneficial, the kind of control also appears to be important. In Study 1, perceptions of constraints and barriers in the environment and ability to cope with barriers surrounding exercise emerged as key correlates of exercise. For intentions, the behavioral specific beliefs, namely coping self-efficacy and PBC, were key correlates. Thus, 'controllability' (at a general level for behavior) and 'capability and confidence' at a behavioral specific level seems to be important for exercise intentions and behavior. A similar finding emerges from Study 2, where at Time 1 control over the heart problem and self-efficacy for exercise appear to be the key correlates of exercise. Scheduling self-efficacy and PBC both appear to be key correlates of exercise after CR, although only scheduling SE emerges as a significant in the regression.

Results from Study 1 also suggest that the influence of SES on exercise behavior and intentions may be partly explained through control beliefs. In patients attending CR (i.e., Study 2), SES was not related to exercise behavior during CR, but income and social status were related to behavior after CR. This suggests that, for these patients, attending CR may serve to attenuate some of the effects of SES on behavior. However, it is known that higher SES people are more likely to attend CR (Atler et al., 2004; Grace et al., 2002; Harlan et al., 1995), so caution should be used in interpreting the results. Exercise behavior during CR was related to stronger perceptions of control over the heart problem, self-efficacy for exercise and PBC. However, only perceptions of control over the heart problem emerged as significant in the regression analysis. Scheduling self-efficacy beliefs emerged as the key predictor of behavior one month after CR.

The influence of SES and control beliefs on behavior was generally supported in these studies. Further, these studies identified some variables that may be important for

future exercise research. For example, in both studies income and subjective social status appeared to be the key SES variables in terms of their association with moderate effort exercise. Self-efficacy beliefs emerged as key correlates of exercise in both studies. Additionally, results from Study 1 support the inclusion of broader, more generalized control beliefs when examining exercise. While domain specific beliefs related to health (e.g., control over the heart problem in CR patients) may be important during rehabilitation or treatment, it appears that such beliefs may not be strong correlates of exercise once treatment has ceased. However, this may be disease and context specific. For example, patients attending CR may be more likely to perceive that they have been 'cured' after treatment or rehabilitation is complete (cf. Gump et al., 2001) than other groups of patients (e.g., cancer, Type II diabetes). Future research could examine whether health or disease specific control beliefs are important correlates of health promoting behavior such as exercise once rehabilitation or treatment is over.

Future research should continue to examine the role of generalized control beliefs on exercise. While behavioral specific control beliefs are certainly important correlates of exercise, understanding how broader based beliefs play a role in exercise may enhance our understanding of behavioral enactment. Specifically, beliefs that reflect potential constraints or barriers in life in general appear to be important. Additionally, future research should examine whether control beliefs mediate the association between SES and behavior, where behavior is assessed prospectively in a random sample. The results of these studies would be worth repeating in other samples as well. For example, recent research examining exercise among people with Type II diabetes (Barrett et al., 2007) has shown a positive association between income and exercise, between income and self-

efficacy, and between self-efficacy and exercise. While Barrett et al. did not test for mediation, it is possible that self-efficacy beliefs mediated the association between income and exercise in people with Type II diabetes. Research should continue to examine SES influences on exercise, and explore for potential mediators in the relationship between SES and exercise. Additionally, in light of the results of the Study 1, it may be worthwhile to consider broader based control beliefs, such as control over life, in clinical samples.

The results of these two studies offer support for the idea that both generalized (e.g., mastery beliefs, control over a disease) and behavioral specific beliefs relate to SES and exercise behavior. Further examination of multiple kinds of control may help refine conceptualizations of control. While the present studies differentiated control beliefs by domain specificity, there are other ways in which control beliefs can differ. For example, Lachman (2000) and others (Hagger et al., 2002; Terry & O'Leary, 1995) have argued that control beliefs also differ in terms of internal beliefs (also referred to agency beliefs or efficacy based beliefs) which relate to perceived abilities of the self, and external beliefs which relate to barriers (also referred to as constraints). It may be worthwhile to explore further conceptualizations of control, and how they relate to SES and exercise behavior. Results from these two studies suggest that control beliefs that relate to barriers both in life and with exercise may be particularly important. Perhaps internal or agency beliefs are more relevant for exercise adoption, whereas beliefs related to barriers are important for exercise maintenance. Continued examination of how SES and multiple kinds of control relate to behavior may help guide future psychosocial interventions.